

TANDY 200 Multiplan Manual

Cat. No. 26-3860



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To Our Customers

Multiplan is an electronic worksheet—a large grid of entries, each of which can be words, titles, numbers, or formulas. But more, Multiplan can replace your pen and paper and your calculator because Multiplan can perform calculations.

Multiplan frees you from the limitations of more traditional methods of calculation. Because Multiplan remembers relationships between entries on a worksheet, it can automatically perform calculations. This lets you test out plans by putting different values into your formulas. If one number changes, what is the effect on the worksheet?

For example:

What if costs rise 10% for 1 item and 6.5% for another? What if production increases? What if sales of one item skyrocket? What if home utility bills soar?

Is it worth it to pay express freight to get a product early? Is it worth it to give a discount to marginal buyers?

Simply alter a critical number and watch the figures change across your worksheet. You can run sensitivity analyses, do budget and resource planning, and schedule more efficiently. You'll soon find that Multiplan is a vast improvement over "hand calculating" methods.

Multiplan overcomes the limitations of paper worksheets. It offers a worksheet with 99 rows and 63 columns. You can, as necessary, instantly insert or erase data, widen or shrink columns; thereby eliminating the costly and tiresome work of typing or hand printing the worksheet over and over. A Multiplan worksheet is always flexible.

How to Use This Manual

Before reading this manual, we suggest you read the *Tandy 200 Owner's Manual*. The owner's manual gives a brief overview of how Multiplan works and how it relates to the other Tandy 200 programs.

We then suggest you go through Section I of this manual, "Using Multiplan." This section is written as a tutorial and runs through many of Multiplan's more advanced features.

For complete information on Multiplan, refer to Section II, "Multiplan Reference." This section contains reference information on all Multiplan's features.

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*Section I/
Using Multiplan*

Chapter 1/ Building a Worksheet

In this chapter, you will build a worksheet containing a financial analysis for a model company—Spencer Ceramics. In building this worksheet, you will review what you learned in the *Tandy 200 Owner's Manual* and learn additional commands for moving within the worksheet and reformatting the worksheet.

Spencer Ceramics

A large industrial firm wants to buy Spencer Ceramics and has asked you for Spencer Ceramics' financial statement. Figure 1.1 is a brief schetch of the statement you need to build.

Starting Up

Enter **MSPLAN** and, when asked for the name of a file, type **SPENCE** (**ENTER**). Press (**LABEL**) to display the function key descriptions.

You see:

	1	2	3	4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
	Edt	Blk	Copy	Form
	Name	Opt	Tran	Menu
	[1]	[2]	[3]	[4]
	[5]	[6]	[7]	[8]

[illegible]

Figure 1.1. Statement for Spencer Ceramics

Moving Within the Worksheet

Use the arrow keys, as you did in the Tandy 200 Owner's Manual, to move around within the worksheet. As you recall, although you can see only a small portion of the worksheet at a time, the Multiplan worksheet actually contains 63 columns and 99 rows.

Your row/column position within the worksheet is called the **current cell**. For example, if you are at the top left corner of the worksheet, you are at Cell R1C1 (row 1 column 1).

To move quickly to the start and end of the worksheet, you can use the following special combination of keys.

To move to the end: Press **CTRL** and **I** (Press **CTRL** and, while holding down **CTRL**, press **I**).

To move to the start: Press **CTRL** (Press **CTRL** and, while holding down **CTRL**, press **I**).

To move quickly to a certain cell you can use the Transfer function key. Press Transfer (**F7**) and you see 4 selections on the "command line" at the bottom of the screen.

You see:

	1	2	3	4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
	Load	Save	Clear	Goto
(1)	(2)	(3)	(4)	(5)
(6)	(7)	(8)		

Choose GOTO by pressing **(F5)**. The command line for Transfer Goto shows "Goto:" followed by a cell position, such as R1C1. Enter the cell position where you want to go. For example, if you want to go to the cell at Row 50, Column 15, type:

Goto: R50C15 **ENTER**

Note that when you pressed the Goto key, Multiplan "proposed" that you go to a certain cell, such as R1C1. Multiplan often proposes a response that it "thinks" is appropriate.

Multiplan makes proposed responses so that the worksheet will be simpler for you to use. If you agree with Multiplan's proposed response, you can simply press **ENTER** without having to type the new response.

Entering Headings

Begin preparing the worksheet for Spencer Ceramics by entering the row headings. Move to Cell R3C1 and type **Sales** (ENTER). You see:

	1	2	3	4
1				
2				
3	Sales			
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Move to cell R5C1 and enter the next heading—this time, by typing **Cost** (ENTER). You see:

	1	2	3	4
1				
2				
3	Sales			
4				
5	Cost			
6				
7				
8				
9				
10				
11				
12				
13				
14				

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Note that the (ENTER) key accomplished 2 tasks: It entered the word "Costs" and also moved down 1 line.

Move to cell R8C1 and enter the last row heading by typing **Gross Profits** (ENTER). You see:

	1	2	3	4
1				
2				
3	Sales			
4				
5	Cost			
6				
7				
8	Gross Pro			
9				
10				
11				
12				
13				
14				

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Reformatting Column Widths

Note that the columns are not wide enough to display all the characters in "Gross Profits." You can change this by using the Format function key to widen the columns. Press Format (F4). On the command line you see:

Cell Wide

Select the Wide key by pressing (F3) and you see:

WIDTH of cells: 9

Again, Multiplan is proposing a response. This time, Multiplan is proposing a width of 9, which is the current width of all the columns. Change this response to 15. Type 15 and watch as the columns widen.

You see:

	1	2
1		
2		
3	Sales	
4		
5	Cost	
6		
7		
8	Gross Profits	
9		
10		
11		
12		
13		
14		

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Entering Numbers

Spencer Ceramics' monthly sales were \$20,000; its costs were \$15,000. Move to R3C2 and type **20000** (ENTER); then move to R5C2 and type **15000** (ENTER).

Note: Do not use commas (20,000), spaces (20 000), or dollar signs (\$20000) when entering a number. You will see why in the next chapter.

You see:

	1	2
1		
2		
3	Sales	20000
4		
5	Cost	15000
6		
7		
8		
9		
10		
11		
12		
13		
14		

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Reformatting Cells

Since all these numbers have to do with finances, you may decide you would like to display the dollar signs. You can do this with the Format function key.

Press Format (F4) and the Format command line shows:

Cell Wide

Choose Cell by pressing (F2) and the Format Cell command line shows 4 fields with 4 proposed responses. You can use (TAB) to move between the top fields and the function keys to control the bottom fields.

Cells:	R5C2	# Dec:	2
Left Den	Right	Fix	Den \$

The **cells:** field lets you specify which cells you want reformat. Multiplan proposes R5C2, which is the current cell. Change this response to a range of cells (from row 1, column 1 to row 15, column 15) by typing **R1C1:R15C15**.

Note: If field you want to change—in this case, the "cells:" field—is not highlighted, you can move to the field by pressing (TAB). Then type the new response.

The **Dec:** field lets you specify the number of decimal places you want Multiplan to use when displaying numbers. Multiplan suggests 2, which is the response you want, so leave this response as is.

The **Left/Cen/Right** field lets you choose how you want all text aligned. The meaning of the choices are:

Settings	Examples	Effect
Ctr	Sales \$1000.25 \$50.25	text and numbers centered
Left	Sales \$1,000.25 \$50.25	text and numbers flush left
Right	Sales \$1000.25 \$50.25	text and numbers flush right

Multiplan suggests “right” which is the response you want, so leave this response as is.

The **Fix/Gen/\$** field lets you choose how you want numbers displayed. The meaning of the choices are:

Settings	Meanings	Examples
Fix	Fixed Point	4.513
Gen	General	text and numbers shown in standard format
\$	Dollars	\$20000.00 (\$150.00)

Multiplan suggests “Gen”. Change this to “\$” by pressing **(F8)** which is the function key directly under “\$”.

The command line should now show that you want to reformat all the cells from R1C1 to R15C15. It should also that you want the cells right aligned and you want numbers displayed with 2 decimal places and dollar signs. Press **(ENTER)** to enter this command.

You see:

	1	1	2
1			
2			
3	Sales	\$20000.00	
4			
5	Cost	\$15000.00	
6			
7			
8	Gross Profits		
9			
10			
11			
12			
13			
14			
Edit Blnk Copy Form Name Opt Tran Menu			
[1] [2] [3] [4] [5] [6] [7] [8]			

Now exit Multiplan and return to the main Menu. Press the Menu function key **(F8)**.

Chapter 2/ Entering Formulas

In this chapter, you will continue to work with the Spencer Ceramics worksheet. You will learn how to insert additional text into the worksheet and will also learn how to easily enter formulas.

Starting Up

Enter SPENCE.CO. Note that you are at the same position in the worksheet that you were in when you last exited the worksheet. Press **(LABEL)** to display the function key descriptions.

Inserting Text

The monthly costs for Spencer Ceramics is \$15000. This is a breakdown of these monthly costs:

Materials	\$4000.00
Labor	\$7000.00
Overhead	\$4000.00
Total Costs	\$15000.00

To insert this cost breakdown into the worksheet, move to R6C2 and press **(PASTE)**. You see the paste command line which is showing 3 fields with 3 proposed responses:

1	1	2
2		
3	Sales	\$20000.00
4		
5	Cost	\$15000.00
6		
7		
8	Gross Profits	
9		
10		
11		
12		
13		
PASTE #: 1 before: R6C2		
	Row	Col
14	1	2

The **PASTE #:** field lets you specify the number of rows or columns you want to insert. Multiplan suggests 1. Change this by typing 5.

The **before #:** field lets you specify where to insert the rows or columns. Multiplan suggests R6C2, which your current position. Leave this response as is.

The **Row/Col** field lets you choose whether to insert rows or columns. Multiplan suggests rows. Leave this response as is.

The Paste command line should now show that you want to insert 5 rows at R6C2, your current position. Press **(ENTER)**; then use the arrow keys to see that the rows have been inserted.

Now that you have inserted new rows, you need to format the cells again. You have done this once before. Press **(F4)**, for Format, and then **(F2)**, to select Cells. Type R1C1:R15C15 in response to the "cells:" field and press **(F8)** to select the dollar format. Then press **(ENTER)**.

Entering Additional Text

You can now enter information into the rows you have inserted. Go to R6C1 and type **Material** **(↓)** **Labor** **(↓)** **Overhead** **(↓)**. Then go to R10C1 and type **Total Costs** **(↓)**.

You see:

1	1	2
2		
3	Sales	\$20000.00
4		
5	Cost	\$15000.00
6	Material	
7	Labor	
8	Overhead	
9		
10	Total Costs	
11		
12		
13		
14		
Edit Blank Copy Form Name Opt Tran Menu		
15	1	2

Now enter the numbers. Go to R6C2 and type **4000** **(↓)** **7000** **(↓)** **4000** **(ENTER)**. You see:

1	1	2
2		
3	Sales	\$20000.00
4		
5	Cost	\$15000.00
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	
11		
12		
13	Gross Profits	
14		
Edit Blank Copy Form Name Opt Tran Menu		
15	1	2

Reformatting Cell Alignments

The worksheet now has 2 levels of headings: the major headings (such as "Cost") and the sub-headings (such as "Material"). To make these 2 levels of headings easier to read, you can realign all major headings to the left.

Move to "Sales" and press **(F4)**, for Format. Then press **(F2)**, for Cell. The Format Cell command line shows the 4 fields with 4 proposed responses.

For the **cells:** field, Multiplan suggests the cell you are currently in. Leave this response as is.

The **# Dec:** field is only for numbers so you can ignore this response.

For the **Left/Cen/Right** field, Multiplan suggests "right." Press **(F2)** to change this response to "left."

The **Fix/Gen/\$** field only for numbers so you can ignore this response.

The command line should now show that you want the current cell realigned to the left. Press **(ENTER)** and you see:

1	1	2
2		
3	Sales	\$20000.00
4		
5	Cost	\$15000.00
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	
11		
12		
13	Gross Profits	
14		
Edit Blank Copy Form Name Opt Tran Menu		
15	1	2

Realign the other major headings—"Cost," "Total Cost," and "Gross Profits"—in the same way that you realigned "Sales."

Blanking Cells

Since you now have a "Total Costs" row, where you will insert the formula for the total costs, you no longer need the \$15000.00 in the "Costs" row. To erase the \$15000, you can use the BLANK function key.

Move to "\$15000.00" and press **(F2)**, for Blank. You see:

Blank cells: R5C2

Multiplan has proposed that you want to blank R5C2, which is the current cell. This is the response you want so press **(ENTER)** and you see the cell erased:

	1	2
1		
2		
3	Sales	
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total costs	
11		
12	Gross Profits	
14		
Edit Blnk Copy Form Name Opt Tran Menu		

Entering Formulas

er the total costs. The best way to do this is as a formula; then, whenever any cost changes, Multiplan automatically will recalculate the formula for total costs.

One way of entering a formula is as you did in the *Tandy 200 Owner's Manual*. In this example you would move to where you want the formula and type:
 $=R6C2 + R5C2 + R4C2$ **(ENTER)**.
 This would tell Multiplan to add the values contained in those three cells.

An easier and better way of doing this is as follows:

1. Move to where you want the formula (R10C2) and press $=$ (equal sign). You see:

	1	2
1		
2		
3	Sales	
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	
11		
12	Gross Profits	
14		
Value: =		

2. Move to the top \$4000.00. You see:

	1	2
1		
2		
3	Sales	
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	
11		
12	Gross Profits	
14		
Value: =R[-4]C		

3. Press $+$ (plus sign). Watch how the formula builds.
4. Move to \$7000.00
5. Press $+$ (plus sign).
6. Move to the bottom \$4000.00. You now see the entire formula.

	1	2
1		
2		
3	Sales	
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	
11		
12	Gross Profits	
14		
Value: =R[-4]C+R[-3]C+R[-2]C		

Press **(ENTER)** to enter the formula and watch as Multiplan calculates the total costs. You see \$15000 as the result:

	1	2
1		
2		
3	Sales	
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	\$15000.00
11		
12	Gross Profits	
14		
Edit Blnk Copy Form Name Opt Tran Menu		

Note: If you do not see \$15000.00 as the result, perhaps you entered the 3 costs

(materials, labor, and overhead) in the wrong positions. If you see "VALUE#" as the result, perhaps you typed a space, a comma, or a dollar sign when entering the 3 costs. In either case, you need "blank" the costs that you entered incorrectly and re-enter them.

To review the formula you just entered, move to \$15000, and press **(F1)**, the EDIT key. You see the formula for this cell on the command line:

$R10C2 = R[-4]C + R[-3]C + R[-2]C$

This meaning of this formula is:

R10C2 the contents of the current cell
 $=$ equals
 $R[-4]C$ the contents of the cell 4 rows up in the same column
 $+$ plus
 $R[-3]C$ the contents of the cell 3 rows up in the same column
 $+$ plus
 $R[-2]C$ the contents of the cell 2 rows up in the same column

Note that Multiplan uses "C" without a number to represent the current column. Press **(SHIFT)(BREAK)** to exit the "edit mode."

Using a Formula

Now that you have entered a formula, you can use it to calculate "what ifs." For example, move to \$4000.00, the costs for materials, and type **6000** (ENTER). Watch as Multiplan readjusts the total costs:

1	1	2
2		
3	Sales	
4		
5	Cost	
6	Material	\$6000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9		
10	Total Costs	\$17000.00
11		
12	Gross Profits	
13		
14		
Edit Blnk Copy Form Name Opt Tran Menu		
[1] [2] [3] [4] [5] [6] [7] [8]		

Now change total costs back to \$4000.00 by typing **4000** (ENTER). To make the worksheet easier to read, draw a line just above the figure for total costs. Move to R9C2 and type
----- (ENTER). You see:

1	1	2
2		
3	Sales	
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$7000.00
8	Overhead	\$4000.00
9	-----	
10	Total Costs	\$15000.00
11		
12	Gross Profits	
13		
14		
Edit Blnk Copy Form Name Opt Tran Menu		
[1] [2] [3] [4] [5] [6] [7] [8]		

Reviewing and Editing Cells

The edit key lets you see what is actually contained in a cell. For example, if you use the edit key to look at R6C2, you will see the number 6000; if you use the edit key to look at R10C2, you see the formula $R10C2 = R[-4]C + R[-3]C + R[-2]C$.

While using the edit key to review a cell's contents, you can use any of the special editing keys available with the Tandy 200 TEXT program to edit that cell's contents. For example, you can use the \leftarrow and \rightarrow keys to position the cursor to a certain character and then use (SHIFT) (DEL) to delete the character.

The #VALUE Error Code

If Multiplan cannot calculate the result of your formula, it displays an "error value" as the result. For example, move to \$4000.000 and, instead of typing 4000 (ENTER) as you did before, type \$4000.00 (ENTER).

Because you entered \$4000.00 with a dollar sign, Multiplan "thinks" that \$4000.00 is a word. Since Multiplan cannot add words with numbers, it displays #VALUE, an error code, as the result of the total costs' formula. To correct this problem, move to \$4000.00 and re-enter it as a number by typing 4000 (ENTER).

Examples of other error values are #DIV/0!, #N/A, #NULL!, #NUM!, #REF!, and #NAME. Multiplan always displays an error value in all caps and precedes it with a number sign (#). The meaning of Multiplan's error values are in Section II of this manual.

Saving Worksheets on Tape

You have already learned that anytime you exit Multiplan, your worksheet is automatically saved in RAM. You may also want to save the worksheet on tape as a backup or as a way of freeing up memory in RAM.

To save the worksheet on tape press (F7), the Transfer key. The Transfer command line shows:

Load Save Clr Goto

Choose Save by pressing (F3). The Transfer Save command line shows 2 fields:

SAVE filename:	
Norm SYLK	
[1] [2] [3] [4] [5] [6] [7] [8]	

The Save filename: field lets you specify the name of the file you want to save. Type CAS:SPENCE.

The Norm/SYLK field lets you choose which format you want to use for saving the file. Multiplan suggests Norm, which is the response you want for all normal applications, so leave this response as is. (The SYLK format is discussed in the appendix.)

Now prepare the recorder for recording. Press the (ENTER) key and Multiplan saves the worksheet on tape.



Chapter 3/ Naming and Copying Cells

In this chapter, you will learn how to conveniently refer to a group of sales as a name, such as “Sales” or “Costs.” You will also learn how to build more powerful formulas by using Multiplan functions.

Loading a File from Tape

Enter Multiplan and press **(LABEL)** to see the function key line. To load the SPENCE worksheet from tape, press **(F7)**, the Transfer command, and choose Load by pressing **(F2)**.

Now prepare the tape for loading and type **CAS:SPENCE**. Then press **(ENTER)** and Multiplan loads the file into RAM. (When using Multiplan to load a file from tape, you must specify a filename.)

Entering Column Headings

As of now, the worksheet contains sales and costs figures for only one month. To be complete, it needs to show these figures for each month of the year.

Move to R1C2. Type **January** and press **(=)**. You see:

	2	3
1	January	
2		
3	\$20000.00	
4		
5		
6	\$4000.00	
7	\$7000.00	
8	\$4000.00	
9	-----	
10	\$15000.00	
11		
12		
13		
14		

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Enter the rest of the months (February-December) on the next 11 columns.

Re-Aligning Cells to the Center

The monthly column headings are aligned to the right, which is Multiplan's default. They would look better aligned to the center.

To accomplish this, you need to reformat them. Move to January, press **(F4)**, for Format and then choose **(F2)** for Cells. You see the same Format Cells command line, which you have seen before.

The **cell:** field, as always, lets you specify which cell to reformat and proposes the current cell (R1C2). You could leave this response as is and reformat each of the 12 column headings individually. But it is much faster to reformat all the column headings at the same time.

To specify all the columns in the current row, you need to change R1C2 to simply R1. To do this, press **(F1)** to enter the edit mode. Notice the double arrows in the upper left corner. Use the arrow keys to move the cursor to the "2" in "R1C2" and press **(BKSP)** twice.

Now press **(F3)** to choose "center" and press **(ENTER)** to enter the command. Multiplan realigns all cells in R1 to the center.

Copying Cells to the Right

You now have financial figures for only 1 month: January. To quickly enter financial figures for all 12 months, use the Copy Right command.

Copy the sales figures first. Move to "\$20000.00" and press **(F3)** for Copy. Then select Right by pressing **(F2)**. The Copy Right command line shows:

Right # cells: 11 at: R3C2
[1] [2] [3] [4] [5] [6] [7] [8]

The **right # cells:** field lets you specify how many times you want the cell copied. Type **11**.

The **at:** field lets you specify which cell you want copied. Multiplan suggests the current cell (R3C2), which is the response you want.

Press **(ENTER)** and Multiplan copies the contents of R3C2 to the next 11 columns. Using the arrow keys, you can see that \$20000.00 has been copied 11 times.

You now need to copy January's material, labor, overhead, and total costs figures to the next 11 columns in the same way that you copied the sales figures. This time, though, you can copy all the rows at the same time by specifying a range of cells.

Specifying a range of cells

Move to the upper left of the area of cells you want copied. In this case, move to the "\$4000.00" next to "Material." Then press **(F3)** for Copy and, as before, select **(F2)** for Copy Right. The command line shows:

Right # cells: 11 at: R6C2
[1] [2] [3] [4] [5] [6] [7] [8]

The **right # cells:** field shows 11, the same response you specified before. You still want to copy to the next 11 rows so leave this response as is.

Move to the **at:** field by pressing **(TAB)**. This time, you do not want to copy only one cell; you want to copy a range of cells. Press **:** (colon). You see:

Right # cells: 11 at: R6C2:
[1] [2] [3] [4] [5] [6] [7] [8]

Using the **(↓)** key, move to \$15000.00. You see:

Right # cells: 11 at: R6C2:R10C2
[1] [2] [3] [4] [5] [6] [7] [8]

Notice how easy it was to specify the range. Now press **(ENTER)** and watch as Multiplan copies the entire range of values.

Naming Cells

You now need to enter the formula for 1 more row of figures: gross profits. As you know, *gross profits* is *sales* minus *total costs*. A formula that uses these names will be easy to build and understand. Before you can build such a formula, however, you need to name some of the cells.

Multiplan lets you name any cell or group of cells, so that you can refer to them more easily. You can, for example, name all the cells containing sales figures as "sales"; then refer to those figures as "sales."

For the gross profits formula, you need to define the cells containing the sales figures and the total costs figures. Start with the sales figures. Move to "Sales" and press (F5), the Name function key. The Name command line shows 2 fields:

NAME: Sales refer to: R3C1
 (1) (2) (3) (4) (5) (6) (7) (8)

The **NAME:** field lets you specify a name. Multiplan's proposed response—"Sales"—lets you quickly use this row heading as the name.

Move to the **refer to:** field by pressing (TAB). This field lets you specify which cells you want to the name to "refer to." Press (←) to move to the first sales figure, which is in Column 2 (January). You see R3C2 in the "refer to" field. Press (:) (colon). Then use (←) to move to the last sales figure, which is in Column 13 (December).

The command line now shows that you want to name all the cells from R3C2 to R3C13 as "Sales." Press (ENTER).

Now name the total costs figures. Move to "Total Costs" and press (F5). You see:

NAME: Total_Costs refer to: R10C2:13
 (1) (2) (3) (4) (5) (6) (7) (8)

Notice that since you are using a similar procedure that you used to define "Sales," both of Multiplan's proposed responses are the responses you want. You need only press (ENTER) to define "Total Costs."

Notice also that Multiplan is using a name that is slightly different from the row heading: The name Multiplan is using is "Total_Costs"; the row heading is "Total Costs". Because Multiplan cannot use a space in a name, it has substituted an underline character (_) for a space.

Reviewing and Deleting Names

If you forget how you have named cells, you can use the Name function key to refresh your memory: Press (F5); then use (←) to "step through" each names. When finished, press (SHIFT)(BREAK).

The only way you can remove a name is to redefine its cells as blank. For example, to remove the name "Sales" (do not do this for now) you would need to press the following keys: (F5), (←) (until "Sales" appears), (TAB), and then (SHIFT)(DEL).

Building a Formula with Names

With sales and total costs defined, it is easy to build a formula for gross profits. Move the R13C2, next to "Gross Profits." You see:

	1	2
2		
3	Sales	\$20000.00
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$6000.00
8	Overhead	\$4000.00
9		
10	Total Costs	\$15000.00
11		
12		
13	Gross Profits	
14		
15		

Edit Blnk Copy Form Name Opt Tran Menu
 (1) (2) (3) (4) (5) (6) (7) (8)

Now type the formula: =Sales-Total_Costs (Be sure to include an underline character, rather than a space, in "Total_Costs.") You see:

Value: =Sales-Total_Costs
 (1) (2) (3) (4) (5) (6) (7) (8)

Press (ENTER) to enter the formula and Multiplan calculates the gross profits. You see:

	1	2
2		
3	Sales	\$20000.00
4		
5	Cost	
6	Material	\$4000.00
7	Labor	\$6000.00
8	Overhead	\$4000.00
9		
10	Total Costs	\$15000.00
11		
12		
13	Gross Profits	\$5000.00
14		
15		

Edit Blnk Copy Form Name Opt Tran Menu
 (1) (2) (3) (4) (5) (6) (7) (8)

Now copy this formula to the right 11 times. (Press (F3), for Copy, (F2), for Right, and type 11 (ENTER).)

Calculating Functions: SUM

It looks as if Spencer Ceramics has made a lot of money. To find out how much, add another column heading for "Sum." Move to R1C14 and type Sum (ENTER). You see:

	13	14
	December	Sum
1		
2		
3	\$20000.00	
4		
5		
6	\$4000.00	
7	\$7000.00	
8	\$4000.00	
9	-----	
10	\$15000.00	
11		
12		
13	\$5000.00	
14		

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

The word "Sum" is centered because you use the Format Cells command earlier to center the entire row.

To calculate the sum of sales, use the Multiplan function SUM. First move to where you want the result to be: R3C14. Then press =. The command line shows:

Value: =

[1] [2] [3] [4] [5] [6] [7] [8]

Type SUM(Sales).

Note: When using any of the Multiplan functions, type the function name followed immediately by an opening parenthesis. Do not leave any space between the function name and the opening parenthesis.

Press (ENTER). You see:

	13	14
	December	Sum
1		
2		
3	\$20000.00	\$240000.00
4		
5		
6	\$4000.00	
7	\$7000.00	
8	\$4000.00	
9	-----	
10	\$15000.00	
11		
12		
13	\$5000.00	
14		

Edit Blnk Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

The #NAME Error Value

Earlier, you learned about the #VALUE error value. When using names in formulas, you might encounter another error value: #NAME.

For example, see what happens to the sum of sales formula if you "undefine" the name "Sales": Press (F5), for NAME, and then press (⇧) until "Sales" appears, (TAB), (SHIFT)(DEL) and then (ENTER).

Multiplan must now compute the sum of "Sales" but does not know what numbers the name "Sales" refers to. To let you know of this problem, Multiplan displays "#NAME" as the sum of sales. And, since the formula for gross profits also includes the name "Sales", Multiplan displays "#NAME" as its result also.

Correct this problem by redefining "Sales." Press (F5) for Name. The Name command line should show a blank for the "NAME:" field and "R3C2:13" for the "Refer to:" field. Re-enter the name by typing Sales (ENTER). You see the correct values for the sum of sales and for gross profits reappear.

Relative v Absolute References

So far, this manual has referred to cell positions in 2 ways: as *absolute* positions, such as R3C14 or R3C14, and as *relative* positions, such as R[-4]C. It has also used names, such as SUM(Sales) or Sales-Total Costs, to refer to absolute or relative cell positions.

The major difference between absolute and relative references appears when copying formulas. If you copy a formula that uses relative references, the formula will use values relative to its new position. If you copy a formula that uses absolute references, the formula will use the values from its old position.

For example, in Chapter 2, you copied a formula for total costs from Column 2 that uses relative references (=R[-4]C + R[-3]C + R[-2]C). Because it uses relative references, each formula that you copied works with values relative to its new position.

If you change a cost from Column 2, this will affect the total costs in Column 2 only. By the same token, if you change a cost in Column 3, this will affect the total costs in Column 3 only.

	col2	col3	col4
row3	1	1	1
row4	2	2	2
row5	3	3	3
row6	6	6	6

Relative Formula in row6:
R[-3]C + R[-2]C + R[-1]C

Now assume that you the total costs formula you copied from Column 2 uses absolute references, such as =R6C2 + R5C2 + R4C2, rather than relative references. By using absolute references, each formula that you copy will work with only with the absolute values from Column 2.

If you change a cost in Column 2, this will change the total costs in all the columns. If you change a cost in Column 3, this will have no affect on any of the total costs in any of the columns.

	col2	col3	col4
row3	1		
row4	2		
row5	3		
row6	6	6	6

Absolute Formula in row6:
R3C2 + R4C2 + R5C2

Changing a Formula to a Relative Reference

For reasons of flexibility, this manual had you use a formula with relative references to calculate total costs. Similarly, if you use a formula with relative references to calculate the sum of sales, you will be able to use the same formula to calculate the sums of total costs and gross profits.

To change the sales formula so that it uses relative references, you need to first edit the formula in R3C14. It now contains formula “=SUM(Sales).” Because names are defined by absolute

references, Sales is handled the same as an absolute reference. You need to change Sales to relative references.

To edit the sales formula, move to R3C14 and press (F1), for Edit. The command line shows the formula in this cell:

Edit: =SUM(Sales)
[1] [2] [3] [4] [5] [6] [7] [8]

Press (→) to move to the end of the formula. Since you are in the “edit mode,” the arrow keys simply move the cursor on the edit line, rather than entering cell references.

To enter relative cell references in the Edit command, press (F1) again. The “Value” prompt replaces the “Edit” prompt. This means that you can use the arrow keys to enter cell references.

Press (BKSP) to erase “Sales”, but leave “SUM(“.

Value: =SUM(
[1] [2] [3] [4] [5] [6] [7] [8]

Press (→) to move to R3C2.

Value: =SUM(RC[-12])
[1] [2] [3] [4] [5] [6] [7] [8]

Multiplan inserts a relative reference into your formula.

Press : (colon).

Value: =SUM(RC[-12]):
[1] [2] [3] [4] [5] [6] [7] [8]

Press (→) once (to R3C13).

Value: =SUM(RC[-12]:RC[-1])
[1] [2] [3] [4] [5] [6] [7] [8]

Press) (right parenthesis).

Value: =SUM(RC[-12]:RC[-1])
[1] [2] [3] [4] [5] [6] [7] [8]

Press (ENTER).

	13	14
1	December	Sum
2	\$20000.00	\$240000.00
3		
4		
5	\$4000.00	
6		
7		
8		
9		
10		
11		
12		
13		
14		

Edit Blank Copy Form Name Opt Tran Menu
[1] [2] [3] [4] [5] [6] [7] [8]

Copying a Formula: The Copy From Command

Now, you can easily use this same formula to calculate the sums for Total Costs and Gross Profits by copying the formula into cells R10C14 and R15C14 using the Copy From command.

Press (F3), for Copy, then (F4), for From. You see:

From: R3C14 to: R3C14
[1] [2] [3] [4] [5] [6] [7] [8]

For the **From:** field, Multiplan proposes that you copy from the current cell. This is the response you want so leave this response as is.

Press (TAB) to move to the to: field. Using (↓), move to Row 10.

From: R3C14 to: R10C14
[1] [2] [3] [4] [5] [6] [7] [8]

This is one of the cells to receive a copy of the formula. The other is in Row 13. Because the cells are not next to each other, you cannot use colon to specify a range of cells, as you have done before. You need, instead, to specify a list of cells by using a comma.

Press , (comma).

From: R3C14 to: R10C14,
[1] [2] [3] [4] [5] [6] [7] [8]

Now use (↓) to move to Row 13.

From: R3C14 to: R10C14,R13C14
[1] [2] [3] [4] [5] [6] [7] [8]

Press **(ENTER)**, and watch the values appear in Rows 10 and 13 of column 14. Use **(D)** to scroll through the worksheet:

	13	14
2		
3	\$20000.00	\$24000.00
4		
5		
6	\$4000.00	
7	\$2000.00	
8	\$4000.00	
9	-----	
10	\$15000.00	\$180000.00
11		
12		
13	\$5000.00	\$60000.00
14		
15		
Edit Blnk Copy Form Name Opt Tran Menu		
[1] [2] [3] [4] [5] [6] [7] [8]		

Before going to the next chapter, move to the beginning of the worksheet. Multiplan always loads a worksheet exactly as it was when you saved it. Use Goto command **(F7) (F5)** to move the cell pointer to R3C2 and press **(ENTER)**.

You can now exit Multiplan by pressing the **(F8)** key which returns you to the main menu. Remember that when you exit Multiplan your worksheet is automatically saved to RAM. Since you opened a new file at the beginning of this section, the worksheet is saved in RAM as SPENCE.CO.

Chapter 4/ Using the Worksheet

In this session, you will use the worksheet to see how Spencer Ceramics' profits change as costs and sales change. You will also learn how to print the worksheet and use special Multiplan options.

Building a Formula to Show Increasing Sales

Enter the SPENCE.CO worksheet. The screen should look just as it did when you last exited this file:

	2	3
	January	February
1		
2		
3	\$20000.00	\$20000.00
4		
5		
6	\$4000.00	\$4000.00
7	\$7000.00	\$7000.00
8	\$4000.00	\$4000.00
9	-----	-----
10	\$15000.00	\$15000.00
11		
12		
13	\$5000.00	\$5000.00
14		
	Edit Blnk Copy Form Name Opt Tran Menu	

The information on Spencer Ceramics indicates that sales have been increasing by about 1% a month. To see the effect of a 1% monthly increase in sales, first move to R3C3, under February, which is the first month that will show an increase.

	2	3
	January	February
1		
2		
3	\$20000.00	\$20200.00
4		
5		
6	\$4000.00	\$4000.00
7	\$7000.00	\$7000.00
8	\$4000.00	\$4000.00
9	-----	-----
10	\$15000.00	\$15000.00
11		
12		
13	\$5000.00	\$5000.00
14		
	Edit Blnk Copy Form Name Opt Tran Menu	

Press =. The command line shows:

Value =
[1] [2] [3] [4] [5] [6] [7] [8]

Using January sales as a base for the remaining months, enter a formula that will calculate each month's sales as a 1% increase over the preceding month's sales. Move to R3C2, under January. The command line shows:

Value: =RC[-1]
[1] [2] [3] [4] [5] [6] [7] [8]

To show February's sales as a 1% increase over January's, you need to multiply January's sales by 101% (that is, February sales are 101% of January's).

Press * (the asterisk is the sign for multiplication).

Value: =RC[-1]*
[1] [2] [3] [4] [5] [6] [7] [8]

Now type 101% (use the number 1, not the lowercase letter l).

Value: =RC[-1]*101%
[1] [2] [3] [4] [5] [6] [7] [8]

Press **(ENTER)**. You should see the new cell value for February showing a 1% increase over the previous month, January.

	2	3
	January	February
1		
2		
3	\$20000.00	\$20200.00
4		
5		
6	\$4000.00	\$4000.00
7		
8		
9		
10		
11		
12		
13		
14		
	Edit Blnk Copy Form Name Opt Tran Menu	

Copying a Formula to the Right: The Copy Right Command (Review)

Because January acts as the "base" month for the 1% increase, the cell for January Sales does not contain a formula. You will therefore be copying the formula for February Sales into the remaining 10 months of the year. To copy this formula to the right, be sure the cell pointer is on R3C3 (under February), and press **(F3)** for Copy.

Right Down From
[1] [2] [3] [4] [5] [6] [7] [8]

Press **(F2)** for Right.

For the **Right # cells:** field, type 10.

Right # cells: 10 at: R3C3
[1] [2] [3] [4] [5] [6] [7] [8]

For the **at:** field, Multiplan suggests R3C3, the current cell. That is where you want to start because the other 10 cells are to be copies of this cell. Leave this response as is.

Press **(ENTER)**, then use **(→)** to scroll through the worksheet to see the results.

January	\$ 20000.00
February	20200.00
March	20402.00
April	20606.02
May	20812.08
June	21020.20
July	21230.40
August	21442.71
September	21657.13
October	21873.71
November	22092.44
December	22313.37
SUM	\$253650.06

Move to R3C14 to see the sales figures resulting from a 1% monthly increase. The formula was copied to the remainder of the year, and the cells that depended on sales figures (gross profits and sum of sales, for example) have been updated to include the new information.

What If . . . ?

The SPENCER worksheet is based on the assumption that the company will have \$20,000.00 in sales in the "base" month (January). The rest of the sales figures are calculated from a formula that assumes a sales increase of 1% per month. All the cost figures are the same for each month.

What if the actual "base" figures (figures you typed in rather than figures calculated from formulas) are different from the estimates you typed in? You would want to change the "base" figures, but would want to protect your formulas (especially those for calculating total costs and gross profits) from alteration. How do you protect your formulas from accidental alterations? And how do you quickly find which cells contain the "base" figures?

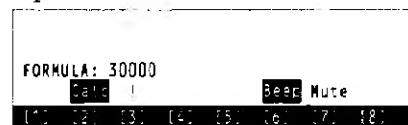
The Options Command

As you have seen, if you change the contents of a cell, such as January Sales, Multiplan recalculates all of the cells that depend upon that cell.

Use the Goto command to move to R3C2. Change January sales by typing 30000. Press **(ENTER)** and scroll through the worksheet to see how the remaining sales and profits figures change.

Likewise, if you change the formula in R3C2 (under February), to reflect a 2% increase (*102%), Multiplan will automatically recalculate the worksheet.

If your worksheet contains many formulas, each change may require several moments to complete the recalculation. To speed up entering a number of changes, you can turn off the automatic recalculation option by using the Options command. Press **(F6)**.



Select **(F3)** to turn off the automatic recalculation and press **(ENTER)**.

Now change the number for January sales to 10000 and press **(ENTER)**. You will see that only the cell for January sales changed.

	2	3
1	January	February
2		
3	\$10000.00	\$30300.00
4		
5		
6	\$4000.00	\$4000.00
7		
8		
9		
10		
11		
12		
13		
14		

Edit Blnk Copy Form Name Opt Tran Menu
1 2 3 4 5 6 7 8

During the time the option to recalculate is turned off, you can do a 1-time calculation by pressing the Recalc key. Press the Recalc key **(F1)** and watch the screen. The worksheet has been recalculated. "Gross Profits" (row 13) now shows losses in parentheses.

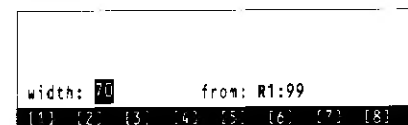
3	2	3
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15	(\$5000.00)	(\$4900.00)
16		

Edit Blnk Copy Form Name Opt Tran Menu
1 2 3 4 5 6 7 8

Use the Options command to change back to automatic recalculation (**(F6)** for Options, **(F2)** for automatic recalculation, **(ENTER)**).

The Print Worksheet Command

To print the entire worksheet, press **(SHIFT) (PRINT)**. The command line shows:



Multiplan proposes 70 characters for the "Width" prompt. This is the number of characters to be printed on a line. For the

"from" prompt, Multiplan proposes the entire worksheet (from row 1 to row 99). These responses are what you want, so simply press **(ENTER)**.

The printed pages should look something like the illustration in Figure 4.1.

By changing the response in the "from" prompt of the Print Worksheet command, you can select the portion of the worksheet you want to print. For example, you could specify just the column showing the sums for sales, costs, and gross profits (column 14).

Note: If you should accidentally press **(PRINT)** or **(SHIFT) (PRINT)**, when the printer is not connected or not turned on, press **(BREAK)** to regain control of Multiplan.

Learning More about Multiplan


The example of Spencer Ceramics is completed.

Multiplan provides many additional mathematical, financial, and statistical functions for calculations and problem solving. (So far you have only seen SUM.) For complete information about Multiplan, refer to Section II of this manual.

Section II Multiplan Reference

	January	February	March
Sales	\$10000.00	\$10100.00	\$10201.00
Cost			
Material	\$4000.00	\$4000.00	\$4000.00
Labor	\$7000.00	\$7000.00	\$7000.00
Overhead	\$4000.00	\$4000.00	\$4000.00
Total Costs	\$15000.00	\$15000.00	\$15000.00
Gross Profits	(\$5000.00)	(\$4900.00)	(\$4799.00)
April	May	June	July
\$10303.01	\$10406.04	\$10510.10	\$10615.20
\$4000.00	\$4000.00	\$4000.00	\$4000.00
\$7000.00	\$7000.00	\$7000.00	\$7000.00
\$4000.00	\$4000.00	\$4000.00	\$4000.00
\$15000.00	\$15000.00	\$15000.00	\$15000.00
(\$4696.99)	(\$4593.96)	(\$4489.90)	(\$4384.80)
August	September	October	November
\$10721.35	\$10828.57	\$10936.85	\$11046.22
\$4000.00	\$4000.00	\$4000.00	\$4000.00
\$7000.00	\$7000.00	\$7000.00	\$7000.00
\$4000.00	\$4000.00	\$4000.00	\$4000.00
\$15000.00	\$15000.00	\$15000.00	\$15000.00
(\$4278.65)	(\$4171.43)	(\$4063.15)	(\$3953.78)
December	Sum		
\$11156.68	\$126825.03		
\$4000.00			
\$7000.00			
\$4000.00			
\$15000.00	\$180000.00		
(\$3843.32)	(\$53174.97)		

Figure 4.1. Printed Multiplan Worksheet



Chapter 5

Elements of Multiplan

This chapter is divided into four sections that describe Multiplan structure, features, and operation. Details of the commands, functions, and messages are described in separate sections and are covered only generally in this section.

The Multiplan Worksheet

The worksheet is a rectangle with an arrangement of intersecting rows and columns. The sheet may be up to 63 columns wide and 99 rows long. An area one column wide by one row high is called a cell.

Each cell possesses both a value that may be displayed on the Multiplan screen and a formula for computing that value. This formula may be as simple as the number 19.95, or it may be more complex, containing functions and references to other cells; for example, "previous cell times growth rate."

The potential dependence of the value of one cell on the values in other cells is the key idea behind the worksheet. When cells have been connected by references among them, a change in one cell (for example, changing 19.95 to 18.50), causes Multiplan to calculate the effect of the change on all other cells. This process is called "recalculating the worksheet." Recalculation may be automatic after every change, or it may be turned off (see the Options command in the "Command Directory" section. When automatic recalculation is turned off, one-time recalculation may be caused by pressing the RECALC key (F1).





The order of calculating the cells is automatically chosen by Multiplan so that the calculation of each cell precedes the calculation of other cells that depend on it. If such an order is impossible, the "Circular references unresolved" error message is displayed.

The Multiplan screen is a movable "window" through which to view part of the worksheet. Across the top of the window are column numbers. Down the left edge of the window are row numbers. The row and column numbers tell you what area of the worksheet you are viewing.

Somewhere within the window is a highlighted cell. The highlight is called the cell pointer, and it points to the "active cell." Many operations do something with the active cell.





The actions you want Multiplan to perform are selected by pressing the function key representing a particular command. The command line (displayed by pressing the LABEL key) is discussed more in "Entering Commands" in this section. The commands are described in the "Command Directory" section.


The cell pointer can be moved around by using the direction keys.


-  moves cell pointer up one cell
-  moves cell pointer down one cell
-  moves cell pointer left one cell
-  moves cell pointer right one cell

When the cell pointer reaches the edge of the window, the window begins to move across the worksheet one cell at a time. This is called scrolling. When the cell pointer reaches the edge of the worksheet, the cell pointer stops, and the Multiplan alarm sounds.

The page keys scroll across the worksheet a whole windowful at a time in the direction selected. The page keys are:

-  moves cell pointer up one page
-  moves cell pointer down one page
-  moves cell pointer left one page
-  moves cell pointer right one page

The HOME key () may be used to go to row 1 column 1 quickly (referred to as R1C1).

The END () key may be used to go to the last row and last column of the active area of the worksheet. The active area is the smallest rectangle that encompasses the cell in the upper left corner of the worksheet (row 1 column 1, R1C1) and the last cell to the right and down that has been given contents or formatting.

When Multiplan starts, HOME and END are both at R1C1.

Entering Commands

You direct Multiplan to perform the tasks you want done by entering commands. The commands are described individually in the "Command Directory" section. This section describes the methods of command entry.

You select a command by pressing the function key that represents that command. The command can be displayed on the bottom line of the screen by pressing the LABEL key. Pressing the LABEL key again turns off the command line display.

Some of the main commands have subcommands. In these cases, when the main command has been chosen, the main command line is replaced with a subcommand line. The subcommand line is displayed even if you have turned off the main command line display with the LABEL key.

To enter a command:

1. Select a cell (move the cell pointer to the appropriate cell), if required by the command to be selected.
2. Select a command.
3. Select responses for the command fields. The responses are used to specify where to Goto, what to Format, and so forth.
4. Press **ENTER** to carry out the command. Or, press **BREAK** during the first three steps to cancel the command.

Selecting a cell is described in the section entitled "The Multiplan Worksheet." Steps 2 and 3 are described below.

Select a Command. You select a command by pressing the appropriate function key. (Press **LABEL** to see the command line.)

When you have selected a command, Multiplan displays either a subcommand line or one or more command fields. Typically, a new subcommand line follows the selection of a main command. Select a subcommand as you would a main command.

Continue selecting subcommands until the command fields are displayed. The names of command fields are shown in lowercase letters followed by a colon. For example:

Right # cells: at:

This command line (from Copy Right) has two fields: the "Right # cells:" field and the "at:" field.

Select Responses for the Command Fields. The next step is to enter responses for the command field or fields. There may already be responses in the fields. These are responses proposed by Multiplan. If a proposed response suits your purpose, you need not enter a response in that field. In fact, if the proposed responses in all the fields are suitable, you can just press **ENTER** to carry out the command.

Entering responses proceeds field by field starting at the first one. A highlight indicates the "active" field (the field in which a response is being entered). Other fields will not contain a highlight.

To move the highlight from field to field, press the **TAB** key. Pressing the **TAB** key when the highlight is in the last field returns it to the first field.

You cannot move the highlight to the command line. To select these options, press the function key that represents the option.

Proposed Responses. The proposed response depends on the specific command; thus proposed responses are described with the commands in the "Command Directory" section. However, proposed responses follow a few general principles:

1. When a command field contains a menu, the proposed response is the current setting. For example, the Options command initially appears as:

	1	2	3	4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
FORMULA:				
	Calc		Beep	Mute
	100	120	130	140
	150	160	170	180

with the highlight on *Calc* showing the current setting in the "recalc" field and on *Beep* showing the current setting in the "mute" field. Thus, the same menu may be used to inspect as well as select options in command fields.

2. In other fields, the proposed response will be the one entered the last time the command was used. This simplifies entering a series of related commands.

3. Yet other fields reflect the position or contents of the active cell. For this reason, positioning the cell pointer before selecting a command may be helpful.

All proposed responses may be edited by using the Multiplan Edit command, described in the "Editing" section next.

Editing

Multiplan provides an editing command to edit responses in command fields. Multiplan's Edit command can be used any time you are entering responses in command fields. The Edit command has two modes:

- **Edit** is used to edit the contents of a cell when you do not want to use the direction keys to enter cell references. In the edit mode, the direction keys move the edit cursor within the command field. They do not move the cell pointer. This mode is denoted by the double arrows in the upper-left corner of the display. To enter the edit mode press **F1** once.

- *Value* is used to edit the contents of a cell when you want to use the direction keys to enter cell references. In the value mode, the direction keys move the cell pointer. To enter the value mode, press (F1) twice until the "Value" prompt appears.

To edit the contents of cells, move the cell pointer to the cell, then use the Edit command (F1) for edit mode or (F1)(F1) for value mode) for cells with formulas, and edit the proposed responses in the command line.

Either just after a command is selected or just after pressing the (TAB) key, the whole field containing a proposed response is highlighted.

To *replace* the proposed response: Type the replacement. Multiplan automatically deletes the proposed response as you type the new one.

To *delete* the proposed response and leave the field empty: Press (DELETE). All text that is highlighted is deleted.

To *append* to the proposed response: For cell references (when the message line shows "Cell:."), type a colon (:) or other operator. For other responses, press the (→) then type the additional text.

Once the proposed response is altered, one character or word in the field is highlighted. This highlight is the edit cursor. If you are in the edit mode, the edit cursor may be moved to designate where or what to edit.

The direction keys move the edit cursor/cell pointer as follows:

Key Edit Mode

- (→) moves edit cursor right one character.
- (←) moves edit cursor left one character.
- (↑) moves edit cursor to the beginning of command line.
- (↓) moves edit cursor to the end of command line.

Key Value Mode

- (→) moves cell pointer right one cell
- (←) moves cell pointer left one cell
- (↑) moves cell pointer up one cell
- (↓) moves cell pointer down one cell

To *insert* new text: Type the text. It will be inserted in front of the edit cursor.

To *delete* text: Use (BACKSPACE) to delete characters on the left side of the cursor. Use (DELETE) to delete what is highlighted by the cursor.

To *replace* text: Delete the old text and type the new.

The following formula editing keys simplify the typing of formulas. These keys all insert text in front of the edit cursor:

1. As you begin to enter a formula or just after you enter an operator, the direction keys (as well as the HOME and END keys) can be used to enter a relative cell reference of the form:

$R[\pm n]C[\pm m]$

(See "Formulas" below for an explanation of cell references, relative references, absolute references, and Names.) As you move the cell pointer, the reference will change accordingly. The cell pointer will return to its original position as soon as any key other than a direction key is pressed.

2. Similarly, the direction keys can be used to enter absolute references of the form:

$RnCm$

in fields that accept a cell reference (when the message line shows **Cell:**).

3. Relative references created with direction keys (described under item 1) may be changed to absolute references by pressing the Reference key (@) immediately after the direction keys.

4. Names may be entered easily by pressing the Reference key (@) first, then using the direction keys to step through the list of defined names.

5. Finally, a formula may be replaced with its resulting value by pressing the Recalc key (⌘) after the formula is entered.

Formulas

Formulas are "recipes" for calculating values. When these values are displayed on the computer screen or printed on a printer, they compose the results of a Multiplan worksheet.

Multiplan works with different types of values, which are appropriate in different circumstances:

Value	Use
numbers	used for financial, statistical, scientific, and other calculations.
text	characters treated as words, including numbers in special displays, such as Sales or 6/14/81.
references to cells	used to express dependency of a value in one cell to values in other cells on the worksheet.

Groups of cells can be specified by "intersection," "range," and "union" operators.

logical values used in making conditional, "either-or" (true and false) decisions.

error values used as substitutes for values that cannot be calculated because of a mistake in a formula. For example, the "result" of division by 0 is an error value.

New values may be calculated by combining other values with the operators, described below under the topics "Numbers," "Text," and "References to Cells"; or by using functions, such as MIN or MAX, described in the "Function Directory" section.

Each type of value is described next.

Numbers. Numbers may be written as integers (123), as decimal fractions (123.45), or in scientific notation. In the latter case, an integer or decimal fraction (mantissa) is followed by the letter E and a positive or negative integer exponent. This notation multiplies the mantissa of the number by 10 raised to the given power.

For example:

1.5E+6 means 1,500,000
 12.1E2 means 1,210 (12.1×10^2)
 (note: + sign may be omitted)
 1E-5 means .00001 (1×10^{-5})

Note: When entering numbers in scientific notation, press \square first to enter the Value mode.

Percentages may be written as numbers followed by % (same as division by 100):

15% means .15 (15/100)

Numbers are calculated with 14 digits of precision and a decimal exponent ranging from -63 to $+63$. This means that the smallest positive nonzero number is:

$.1 \times 10^{-63}$

and the largest one is:

$9.9999999999999 \times 10^{+62}$

Mathematical operators are the following:

Operator	Meaning
^	exponentiation. Calculated by the rule: $a^b = \exp(\ln(a) \cdot b)$.
*	multiplication
/	division

% percent (written after the value and has the same meaning as /100)

+ arithmetic addition

- subtraction (may also be used in front of a value to denote "negative")

Operator precedence is: - (negative value) is evaluated first, then %, then ^, followed by * and /, then + and - (subtraction), and finally the logical operators described under "Logical Values." Parentheses may be used to alter the order in which Multiplan performs the calculation when more than one operator appears in a formula.

The "Function Directory" section describes Multiplan functions for performing mathematical, statistical, and financial calculations.

Text. A text value may contain up to 150 characters.

References to Cells. References to cells describe the location of one or more cells on the worksheet. References are the means of access to the values in cells.

A cell reference consists of a row reference and of a column reference, in that order. (You can give cell references by entering the column reference followed by the row reference, but Multiplan stores the reference in row-column order.)

A cell reference indicates the place where a specific row and a specific column intersect.

For example, R4C3 is a reference to the cell at row 4, column 3. Assume that cell R4C3 has the value 5, the result of the formula $R4C3 + 1$ is 6.

		column					
		1	2	3	4	5	
	1						
	2						
	3						
row	4			5			$R4C3 + 1 = 6$
	5						

Figure 1. Cell Reference Gives Access to a Value

References may be written three ways:

- as an absolute reference
- as a relative reference
- as a name reference

Absolute References. An absolute reference consists of the letters "R" and "C" and the actual row number and column number (as illustrated in Figure 1).

The forms are:

Form	Meaning
Rn	row number <i>n</i> (1-99)
Cn	column number <i>n</i> (1-63)
Rn:m	all rows from <i>n</i> through <i>m</i>
Cn:m	all columns from <i>n</i> through <i>m</i>

Placing an R form and a C form together denotes the rectangle formed by the intersection of the rows and columns:

Form	Meaning
RnCm	single cell at row <i>n</i> , column <i>m</i>
Rn:mCp:q	a rectangle of cells

Relative References. A relative reference describes the location of another cell in terms of the location of the current cell. ("Current" means the cell that contains the cell reference.) A relative reference gives a direction by "+" for right or down, or "-" for left or up, and a number indicating how many rows or columns away from the current cell.

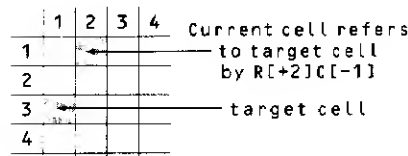


Figure 2. Relative Cell Reference

The "target" cell is 2 rows down from the current cell (+2) and 1 column left of the current cell (-1).

The forms of relative references are:

Form	Meaning
R	current row
C	current column
R[+n]	the row that is <i>n</i> rows below R (the + may be omitted)
C[+n]	the column that is <i>n</i> columns to the right of C (the + may be omitted)
R[-n]	the row that is <i>n</i> rows above R
C[-n]	the column that is <i>n</i> columns to the left of C

As for absolute references, placing a relative R form and C form together denotes the rectangle formed by the intersection of the rows and columns. For example:

Form	Meaning
RC[-1]	the single cell just to the left of the current cell

The difference between absolute and relative references becomes apparent only when a reference is copied (see Copy command in the "Command Directory" section). Absolute references will

refer to exactly the same cell or cells in all of the copies. The cells referred to by relative references, however, are different for each copy (see Figure 3):

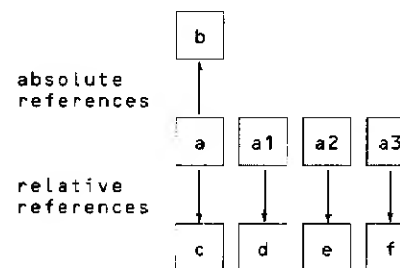


Figure 3. Comparison of Absolute and Relative References

If a reference in cell *a* is absolute and refers to cell *b*, the copied references in cells *a1*, *a2*, and *a3* will all refer to cell *b*.

If a reference in cell *a* is relative and refers to cell *c* as 3 rows down [+3], cell *a1* will refer to cell *d* (not cell *c*), cell *a2* will refer to cell *e*, and cell *a3* will refer to cell *f*.

Names. Names are words used to identify a cell or group of cells. A Name may be defined as an absolute reference with the Name command (see "Command Directory" section). The spelling rules for names are:

Names must start with a letter,

followed by letters, digits, periods, and underline (_) characters,

up to 31 characters maximum.

Words that are the same as absolute or relative references (for instance, R1C1 or R) must not be used for names.

Once defined, a Name may be used as you would use any absolute reference. For example, you might define the name Sales to refer to R3C2:8. The name of the reference suggests that the calculation involves sales figures. The absolute form, R3C2:8, is not mnemonically suggestive of sales figures. However, to the Multiplan program, the meanings are identical.

The name in the example above may be illustrated as:

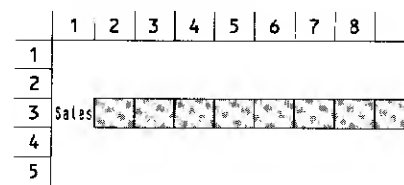
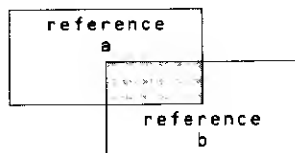


Figure 4. Names as Cell References

Three operators may be used to combine references: intersection, range, and union.

Intersection Operator (Space).
The intersection operator is used to combine two references to refer to all the cells that belong to both references.



Intersection a b refers to the shaded area.
(space)

Figure 5. Intersection Reference

As a specific example,

R C3

(space)

refers to the cell where the current row and column 3 intersect.

	C3	
R	R C3	

Figure 6. Relative-Absolute Intersection Reference

When reference forms are combined (that is, an absolute with a relative, an absolute with a name, a relative with a name, or a name with a name), the intersection operator must separate them to indicate access to the value or values where the two references intersect.

For example: RC3 is not permitted; write R C3 instead.

If the two references do not intersect, Multiplan returns a #NULL! error value.

Range Operator (Colon) (:). The range operator is used to combine two references so that the values in a group of contiguous cells may be used.

The area of a range is the smallest rectangle that includes both references.

Typically, in a reference written as a:b, the "a" reference is in the upper left corner and the "b" reference is in the lower right. For example:

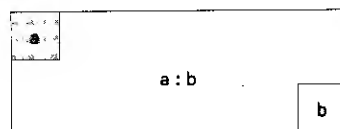


Figure 7. Range Reference

The range operator may be used to combine any of the reference forms (absolute, relative, or name) in any order.

Union Operator (Comma) (,). The union operator is used to combine references to refer to all cells that belong to either reference.

For example:

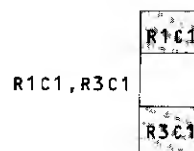


Figure 8.

Each reference in a union may be any form (absolute, relative, or name), an intersection, or a range.

A union usually refers to cells that are not contiguous. Where a union describes contiguous cells, it describes a rectangle as a range reference would. For example:

R1C1,R1C2 equals R1C1:2

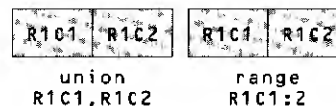


Figure 9.

but R1C1,R3C1 does not equal R1:3C1

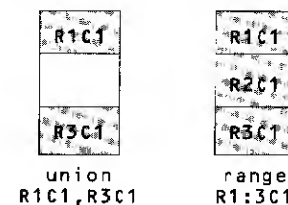


Figure 10.

The range reference in the second example includes cells not specified by the union reference.

References may be used in formulas that require the value of a single cell. When the reference describes a single cell and a single value is required (for example, R1C1+1), the value meant is the value of the cell described plus the value 1. (Note that this value may be a number, text, logical, or error value, depending on the value in the cell referred to.)

When the reference describes a group of cells but a single value is required, Multiplan chooses the value to be used from the cell where the current row or column intersects the group of cells. In particular, for groups that are parts of rows, Multiplan chooses the value in the current column. Similarly, from parts of columns, the value in the current row is chosen. Figure 11 illustrates a use for this feature. Using a group of cells that is neither a row nor a column (or a part of one of these) yields no useful results.

500	600	800	1000	← income
75	90	120		← income*15% = (income C)*15% = 150
				C

Figure 11. Single Value from a Reference to a Group of Cells

The "Function Directory" section contains descriptions of the functions that can process a collection of values (SUM(...) for instance). Any type of reference may be given as an argument to such a function. The value of all the cells that are described, whether one or many, will be processed.

Logical Values. The logical values, true and false, are returned by the comparison operators that compare two numbers:

Operator	Meaning
<	less than
<=	less than or equal
=	equal
>=	greater than or equal
>	greater than
<>	not equal

The functions AND(...), OR(...), NOT(...), TRUE(), and FALSE() also perform logical operations.

The purpose of logical values is to make "either-or" decisions using the IF(...) function. All of these functions are explained in the "Function Directory" section.

Note that text values cannot be compared.

Error Values. When a Multiplan function, operation, or reference is used incorrectly, an error value will result. There are different error values for different error conditions, as described here. Error values "propagate," meaning that operations or functions that result in error values in one cell cause the same error values in all the cells that refer to the first cell. This also means that when one notices an error value in a cell, the propagation has to be unraveled step-by-step until the source of the error is found.

For example, we notice that cell R1C1 displays the #NAME? (undefined name) error value. The formula in R1C1 is $a+1$. We check the definition of 'a' using the Name command. We find that the name 'a' is defined to refer to R1C2. That cell is the next step in the search. When we look in cell R1C2, we may find the cause there, but we may also find references to other quantities which will have to be inspected. We may have to look at more than one cell to find the source of the error.

The error values and their causes are:

Value	Cause
#DIV/0!	result of an attempt to divide by 0.
#NAME?	result of an undefined label reference.
#N/A	result when the value is not available. Also, #NA is a special value that may be created using the NA() function and which will be propagated by arithmetic.
#NULL!	result of specifying an intersection of disjoint areas; e.g., R1 R2 (use union instead, R1,R2).
#NUM!	result of overflow (number is too large or too small) or of an illegal use of an arithmetic function; e.g., SQRT(-1).
#REF!	result of a relative reference reaching outside the sheet or of a reference to a deleted area.
#VALUE!	result of using text where a number is needed or vice versa, or of using references when a value is needed.

Files

The different ways you can store your Multiplan worksheets are described below.

Files are storage mediums for information you create on your computer. They are identified by filenames. Filenames are six character long and must start with a alphabetic letter. Multiplan uses files mainly to store worksheets. Multiplan can read files, and it can write them.

File Handling. You can store your Multiplan worksheets in three different ways:

- **RAM** — You can store Multiplan worksheets as files in your computer's memory. When you exit Multiplan, your worksheet is automatically stored in the computer's memory. Even though your files are stored in memory, you should periodically store them to cassette as backup files.
- **Cassette** — You can also store worksheets to cassette tape. Even if you store files in memory, you should make cassette copies of the files as backups. This is a simple and inexpensive way to store your Multiplan worksheets.

- **Diskette** — If you have disk drives for your computer, you can store your Multiplan worksheets on diskette. The access time (time to read or write a file) is much faster than cassette; however the disk drives are not transportable as a cassette recorder is.

Multiplan reads files when a worksheet is loaded (Transfer Load command) from cassette or diskette in Normal mode or from RAM in any mode.

Multiplan writes the file when a worksheet is saved (Transfer Save command) to cassette or diskette in any mode.

Problems with File Access.

You should be aware of problems to consider when trying to read or write a file. If problems with file access persist, check for possible causes from the following lists.

Problems When Reading.

1. The information may not be in RAM or on the media (cassette or diskette).
2. The information is not reliably readable or is unreadable. You should maintain backup copies of important files.

3. The information is not in the expected format. Check the "mode" setting of the Transfer command.

Problems When Writing.

1. The computer's memory or storage media may become filled. Your computer can store only a limited amount of information in RAM or on cassette/diskette. As more files are stored on them, they may fill up.

2. Previous information stored in a file may be valuable.

When saving to RAM, Multiplan automatically overwrites the existing file.

When saving to cassette or diskette, Multiplan overwrites anything previously stored on the cassette tape or disk file.

3. The cassette or diskette may be write-protected. Consider the reason for write-protection before changing the protection.

4. Errors during writing, such as an interruption, may leave incorrect information on the storage medium. Make sure that write operations are allowed to complete.

Transforming the Worksheet

The information in this section applies to the Insert command (**PASTE**). Refer to the discussions of this command in the "Command Directory" section for additional information.

When rows or columns are inserted, sections of the worksheet may be displaced. For example:

One column is inserted before column 2. This moves the part of the worksheet that is to the right of column 2 one column farther to the right.

Because these commands may change the location of cells, Multiplan also automatically adjusts any references to the cells, whether they occur in formulas or in the definition of names. However, the adjustments to some references after the worksheet has been transformed may cause problems. The problems fall into the following general categories:

1. If the reference is to a group of cells and the transformation would distort a rectangular part of the group into a more complex shape (for example, if a corner cell is deleted from a rectangular area), the name definition is not changed.

2. If cells are inserted adjacent to a group of cells, references to the group are not updated to include the new cells. If the enlargement of the group is desired, the insertion must be made inside of the group rather than at the boundary. If necessary, the new cells may be inserted at an unambiguous place inside the group. Then copy the cell contents as required.

3. If a formula is copied into a number of cells using the Copy Down, Copy Right, or Copy From commands, the relative references in all of the formulas are adjusted equally. The model formula for the adjustment is the first one encountered on the sheet. This means, for example, if the formula

$RC[-1]*1.05$

is copied from R1C2 to R1C14, and if a column is added between columns 5 and 6, all formulas will be adjusted according to R1C2; no change in this case.

Chapter 6

Command Directory

This chapter explains each Multiplan command. At the beginning of each command description, the complete menu for the command or subcommand is shown with proposed responses. The notations this chapter uses for these proposed responses are:

- RC indicates the active cell
- R indicates the row number of the active cell
- C indicates the column number of the active cell
- () indicates a description of proposed response

The examples provided are intended to give you a sample of uses for a command. A short description of the action to be performed precedes a command format with proposed responses in the fields.

To recreate the example yourself, use any of the methods for entering responses until your command line looks like the example.

Related and similar commands are listed under the heading "See Also." Commands that offer subcommands are described only generally under the main command heading. Refer to the subcommand descriptions for the details of performing a particular action.

Blank — Function Key (F2)

BLANK cells: RC

Enter reference to cell or group of cells

Description

Replaces contents of specified cells with blanks. The proposed response permits quick blanking of the active cell.

The format of the cell is not changed. The cell is still available for storing values.

Names are not affected. If a cell was Named before the Blank command was used, that name still applies.

When a formula refers to a blank cell, its number value is taken as zero, or its text value is a blank.

Examples

To blank the cell in row 3 column 2:

BLANK cells: R3C2

To blank all cells in the area named Sales:

BLANK cells: Sales

To blank an irregular area:

BLANK cells: R1:6C1,R7:8

See Also

Transfer Clear to clear the entire sheet.

Copy — Function Key (F3)

Right Down From

Select corresponding Function Key for Right, Down, or From.

Description

Presents a choice of ways to copy some cells into other cells. Both the contents and the formats of the source cells are copied. Source cells are not altered.

Copy Right copies one cell or a column of cells into cells to its right.

Copy Down copies one cell or a row of cells into cells below it.

Copy From is the general form and can be used for all copying on the active worksheet. Copy Right and Copy Down are included because they make a common copying task easier.

The subcommands are explained individually on the following pages.

See Also

Insert to add new cells between existing ones.

Copy Down — Function Keys

F3 F3

DOWN # cells: 1 at: RC

Enter the number of cells to copy down.

Description

Copies the specified cell the number of times specified in the “# cells” field into the cells below it.

The proposed response for the “# cells” field is the number used in the last Copy Down or Copy Right command. The total number of identical cells will be the number specified plus one (for the original).

The command can also copy down a row of cells by specifying a row or part of a row in the “at” field.

Examples

To copy the value and format of R1C1 into the 10 cells below it:

DOWN # cells: 10 at: R1C1

To copy the first five cells in row 1 into the next four rows below:

DOWN # cells: 4 at: R1C1:5

Copy From — Function Keys

F3 F4

FROM: RC to: RC

Enter reference to a cell or a group of cells

Description

Copies the contents of a cell or group of cells to another location on the sheet. Copy From is used, for example, when the source cells and the destination cells are not in the same row or column.

When there is only one source cell, the cell contents are copied into each destination cell.

When the source is a group of cells, the entire group is copied. When only one destination cell is given but the source is a group of cells, the specified destination cell marks the upper left corner of the destination area.

In general, either the source or the destination should consist of a single cell.

In special circumstances, copying vectors can be accomplished. (A vector is a line of two or more cells, either in a row or in a column.) Copying from a row to a row or from a column to a column is allowed if the source and the destination are the same size. If copying is done from a row vector to a column vector, or from a column to a row, the resulting copy is a rectangle in which the source vector is copied starting at each cell of the target vector.

The following diagrams illustrate the results of copying vectors, as described above:

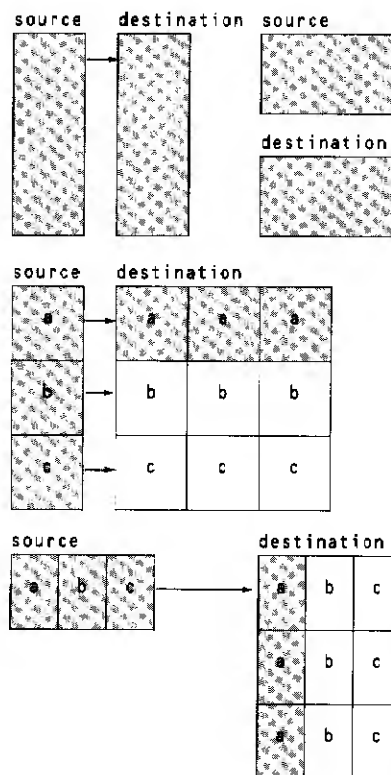


Figure 12. Results of Copying Vectors

If other forms of copies are attempted, the system cancels the copy command and displays the “Illegal parameter” message.

Examples

To copy the contents of cell R1C1 into cell R5C3:

FROM: R1C1 to: R5C3

To copy the contents of cell R1C1 into all cells in column 8:

FROM: R1C1 to: C8

To copy a square patch of cells in the upper left corner of the worksheet into a square patch beginning at R8C1:

FROM: R1:4C1:4 to: R8C1

The upper left cell of the new patch is R8C1. After the copying, R8C1 is a copy of R1C1, R8C2 is a copy of R1C2, and so on to R11C4, which is a copy of R4C4.

Likewise, the same copy can be made by also specifying a destination area that matches the source area:

FROM: R1:4C1:4
to: R8:11C1:4

To copy the first four cells in column three into column six:

FROM: R1:4C3 to: R1C6

for the upper left of area, or

FROM: R1:4C3 to: R1:4C6

for the matching area.

To copy the first four cells in column six three times:

FROM: R1:4C6 to: R1C6:8

The source cells are part of a column while the destination area is part of a row. The source column is copied down beginning at each cell of the destination.

Copy Right — Function Keys

F3 F2

RIGHT # cells: 1 at: RC

Enter a the number of cell to copy right.

Description

Copies the specified cell the specified number of times into the cells to the right of the specified cell.

The proposed response for the “# cells” field is the number used in the last Copy Down or Copy Right command. The total number of identical cells will be the number specified plus one (for the original).

The command can also copy right a column of cells by specifying a column or part of a column in the “at” field.

Examples

To copy the contents of the active cell (R1C1) into the 8 cells to the right of it:

RIGHT # cells: 8 at: R1C1

To copy the contents of the 5 cells in column 1 (R1:5C1) into column 2, giving two side by side columns with the same contents:

RIGHT # cells: 1 at: R1:5C1

Edit — Function Key **F1**

EDIT: contents of RC

Description

Used to edit a formula or value in the active cell.

The current contents are shown in the command line. The edit cursor is placed at the end of the current contents.

After you have edited the cell's contents, press **ENTER**.

Press **BREAK** instead of pressing **ENTER** to cancel your changes and to return to the main command line menu.

If the cell contains a formula, Multiplan checks the formula for errors when **ENTER** is pressed. If the formula contains an error, the erroneous part is highlighted, and the Multiplan Edit command remains active.

See “Editing” in the “Elements of Multiplan” section for the description of the editing keys.

Format — Function Key **F4**

Select the corresponding Function Key.

Description

Presents a choice of various display adjustments.

Format Cell alters the alignment and format of a cell or group of cells.

Format Wide sets the width of all columns.

The display of cell contents is controlled by the settings in the “alignment” and “format” fields of the Format Cell command.

The setting in the “alignment” field controls the placement of the contents within the available spaces of the cell; whether the empty space is placed to the right of the contents, to the left, or on both sides.

The setting in the “format” field, together with the response in the “# Dec” field, controls how the value is displayed, as a number in fixed, general or dollar format.

Format Cells — Format Keys

F4 F2

Cells: RC # Dec: 2

Left Cen Rgt Fix Gen \$

Enter reference to cell or group of cells and select corresponding Function Keys for alignment and format fields.

Description

Alters the alignment and format codes of one or more cells.

The proposed responses are the format codes of the active cell. This command may be used to review the settings for the active cell.

The settings of the active cell may be given to a group of cells by changing the response in the “cells” field.

The alignment codes are:

Cen	Center	Center the cell display in the column.
Left	Left	Left—justify the cell display in the column.
Rgt	Right	Right—justify the cell display in the column.

The format codes are:

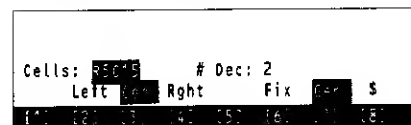
Fix	Fixed point	Numbers are displayed rounded to a fixed number of digits of decimal fraction. The number of decimal places is set in the “# Dec” field of the Format Cell command.
Gen	General	Numbers are displayed as precisely as possible in the available width of the cell, with scientific notation used automatically, as needed.

\$ Dollar Money amounts are displayed with a leading dollar sign and two decimal places. Negative numbers are shown in parentheses.

The “# Dec” field is used only for the Fix and \$ format codes. If you enter a response to this prompt for the other format code, your response is ignored. If you are not specifying one of these two format codes, you can simply press (ENTER) after specifying the format code.

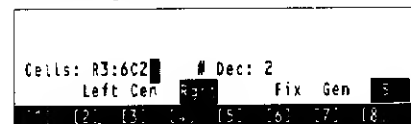
Examples

To align the contents of the active cell (R5C15) in the center of the available spaces:



Press (F3) for center alignment and then (ENTER).

To display the cells in column 2, rows 3 through 6 as money values preceded with a dollar sign and displayed with two decimal places:



Type R3:6C2. Then, press (F4) for right alignment and (F8) for dollar format. Then press (ENTER).

Format Width — Function Keys (F4)(F3)

WIDTH of cells: 9

Enter a number

Description

Sets the width of all columns to the specified width. Width can be from 4 to 30.

If a cell contains text longer than the column is wide, Multiplan cuts off the display at the right edge of the column. Use this command to widen the column width.

If a cell contains a number that cannot be displayed in the column width, Multiplan displays a series of number signs (#) or the number in scientific notation (depending on the format code). This can be fixed by widening the column, or sometimes by using a different format code.

The initial default width is 9 characters.

Examples

To set the column width to 15:

WIDTH of cells: 15

Insert (PASTE)

PASTE #: 1 before: RC
Row Col

Select option.

Description

Inserts row(s) or column(s) into the worksheet.

Insert Row inserts new rows, moving the rest down.

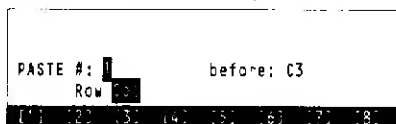
Insert Column inserts new columns, moving the rest to the right.

Multiplan adjusts all references affected by the insertion. See “Transforming the Worksheet” in Part 1 for the description of how the Insert command affects references.

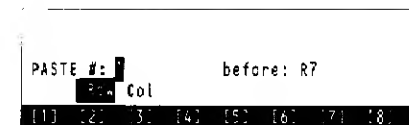
The Insert command will not be carried out if the insertion would push data off the edge of the sheet. If, for example, you have data in column 63, an attempt to insert even one column will receive the message “Illegal parameter.” Similarly, if you have data in column 50 and attempt to insert 14 columns, you will receive the “Illegal parameter” message.

Examples:

To add a column just left of the active one (column 3):



To insert a new row above row 7:



Press (F2) to select row insertion.

Name — Function Key (F5)

NAME: refer to: RC

Enter name

Description

Assigns a name to a cell or area of cells. The name may then be used to refer to that cell or area in a command or formula.

The proposed response for the “NAME” field is either a blank or text. If the active cell contains text, Multiplan proposes that text, with any illegal characters removed, as the name to be defined. This makes it easy to convert a title already given to a row or column into a name.

If cell R5C1 contains the text *Costs* as a title, then the Name command can be used to define the name *Costs* as R5C2:15. Text used as titles and names are very different and should not be confused. However, it will be easier to read your formulas if the names in them correspond to the visible titles on your worksheet.

If you want the name to be something other than the proposed response, simply type the new response.

The proposed response for the "refer to" field is either the active cell or, if the last name defined was a vector (portion of a row or column), the same vector shifted to the active row or column. This feature makes defining parallel groups a simple task.

If the name you enter is already defined, after you press **(TAB)** the proposed response in the "refer to" field shows the current definition.

Names must begin with a letter. The rest of the characters of a name may be any combination of letters, numbers, the period (.), and the underscore (_). (These rules are the same ones used in the BASIC programming language.) Proposed responses are automatically made to conform to these rules. Illegal characters are ignored and underscores are substituted for blanks embedded in text strings.

Names may be up to 31 characters long.

Names may not be a combination of characters that could be confused with a reference. See the descriptions of references in "Formulas," in the "Elements of Multiplan" section.

To see the names that have been defined, select the Name command. Use the direction keys to display each defined name and its definition in the command fields.

To change the definition of a name after viewing it, use the edit keys to alter the response in the "refer to" field and press **(ENTER)**.

Names are deleted by making them refer to no area. Enter the name in the "NAME" field, delete the response in the "refer to" field, and press **(ENTER)**.

Example

To define row 10, columns 3 through 15 as Sales:

NAME: Sales
refer to: R10C3:15

Options — Function Key (F6)

FORMULA: (formula of RC)
Calc ! Beep Mute

Select option by pressing Function Keys

Description

The proposed responses show the current settings.

The "Calc" option controls when Multiplan performs formula calculations. If the "Calc" option is set, Multiplan recalculates all formulas whenever a cell is changed. If the "recalc" option is not set, recalculation is

done only when the RECALC (**(C)**) key is pressed or during Transfer Save.

The length of time Multiplan takes to recalculate a sheet depends on how many cells are in use, and on the complexity of the formulas in them. When you want to make many entries on a busy worksheet, do not set the "Calc" option for quicker response. Set "recalc" again when you want to see the effect of each change.

The "mute" option controls the Multiplan audible alarm. The initial setting is on ("Beep") which means the alarm sounds when an error is made. Select "Mute" when you want to mute the alarm.

The "FORMULA" prompt shows the formula contained in the active cell. The formula may be text, a number or an actual formula.

After you press **(ENTER)**, Multiplan will display in the message line (top line of the screen) the number of bytes remaining. This number is different from the number of bytes displayed when you exit to Menu.

Print Window — (PRINT) Key

Description

Prints the current window (the portion of the worksheet displayed on the screen).

If you wish to stop the printing, press **(BREAK)** (**(SHIFT)** **(PAUSE)**).

If you press **(PRINT)** and the printer is not attached or turned on, you can press **(BREAK)** to regain control of Multiplan.

Print Worksheet — (SHIFT) (PRINT)

width: 70 from: R1:99

Select the width of printout and area to print.

Description

Prints all or a portion of the Multiplan worksheet.

Empty columns at the right of, and empty rows at the bottom of the sheet are not printed. Multiplan prints as many columns across the page as will fit in the print margins. If there are rows left over, it prints a second page, repeating the same columns. When all the rows have been displayed, Multiplan starts the next set of columns on a new page. Thus if the area to be printed is wider than the paper, you can assemble the complete width by cutting and taping later.

If you wish to stop the printing, press **BREAK** (**SHIFT PAUSE**).

If you press **SHIFT PRINT** and the printer is not attached or turned on, you can press **BREAK** to regain control of Multiplan.

The "width" field sets the maximum number of characters to be printed on each line.

If you want to print the entire worksheet, enter R1C1:R99C63 as the range in the "from" field.

If you want to print only part of the worksheet, specify a reference to a rectangular group of cells in the "from" field.

Example

To print the rectangular area starting at R3C10 and ending at R6C14:

width: 70

from: R3C10:R6C14

Transfer — Function Key **F7**

Load Save Clr Goto

Select option.

Description

Offers a choice of four subcommands which affect an entire sheet.

Transfer Load loads a saved sheet from either cassette or disk, replacing the active sheet.

Transfer Save saves the active sheet to a cassette or diskette file. Transfer Save also lets you save SYLK mode files to RAM.

Transfer Clear clears the active sheet, deleting all its contents.

Transfer Goto moves the cell pointer to the specified cell.

The subcommands are explained individually on the following pages.

Transfer Clear — Function Keys **F7 **F4****

CLEAR sheet —

Enter Y to confirm:

Enter Y to confirm or any other key to abort.

Description

Clears the active sheet after you press **Y** to confirm the command. Typing any other key cancels the command.

Using the Transfer Clear command is almost the same as starting up Multiplan; that is, all cells are deleted.

See Also

Blank to replace the contents of specified cells with blanks.

Transfer Save to save the active sheet as a cassette or disk file.

Transfer Goto — Function Keys **F7 **F5****

GOTO cell: RC

Enter reference to a cell

Description

Places the cell pointer on the specified cell, making that cell the active cell.

If the requested cell is already visible through the active window, only the cell pointer is moved.

If the requested cell is not visible through the active window, the active window is shifted so that the named area appears in the specified window.

Transfer Load — Function Keys **F7 **F2****

LOAD filename:

Norm SYLK

Enter a filename in the form:

[CAS:] *filename* indicates a cassette file with the specified filename. CAS: may be omitted.

drive:filename indicates a disk file named *filename*.

Description

Loads a sheet from a cassette or disk file. The file's name must be spelled and punctuated exactly as it was when the sheet was saved with the Transfer Save command.

When a "Normal" mode Multiplan worksheet file is loaded, it replaces the sheet on display (after asking if you want to clear the sheet).

As a special feature, the Transfer Load command can also load worksheets from files written by other systems in ASCII format. Data read from one of these files will be merged with the active worksheet, rather than replacing it. To avoid this merging, first use the Transfer Clear command. See Appendices D and E for more information.

Example

To load a sheet saved on cassette, in a file named INCOME:

LOAD filename:
INCOME

or

LOAD filename:
CAS:INCOME

To load a sheet saved on the disk in Drive 0, in a file named REPORT:

LOAD filename:
0:REPORT

See Also

Transfer Save to save the active sheet as a disk file.

Transfer Save — Function Keys (F7) (F3)

SAVE filename:
Norm SYLK

Enter a filename in the form:

[CAS:] *filename* indicates a
cassette file with the speci-
fied *filename*.

drive:filename indicates a disk
file named *filename*.

Description

Saves the active sheet as a
cassette or disk file, which can
later be loaded with Transfer
Load. The form of filename
given in response to the
“filename” prompt decides
whether the file is saved to
cassette or disk. See the above
specifications.

When saving to disk, if the
filename is a duplicate of one
that exists already, the message
“Overwrite existing file?”
appears when you press (ENTER).

Press (Y) to replace the file on
diskette with the worksheet on
the screen. Pressing any other
key cancels the Transfer Save
command.

You can save your Multiplan
files to cassette or disk in
Normal mode. Symbolic mode
saves the file to RAM in text
format.

Examples

To save the active sheet to
cassette with the name INCOME:

SAVE filename:
INCOME

or

SAVE filename:
CAS:INCOME

To save the active worksheet to
disk with the name PRACTICE:

SAVE filename:
O:PRACTICE

See Also

Transfer Load to load a sheet
saved previously.

Value

VALUE:

Enter a formula.

Description

Used to enter a formula or a
number into the active cell.

You enter the value command by
typing any digit or an equal sign
(=).

Inside formulas the direction
keys enter relative references into
the formula. See “Editing” in
the “Elements of Multiplan” sec-
tion for more information about
responses to a command.

Terminate the Value command
by:

1. pressing (ENTER).
2. pressing an action key that
moves the cell pointer, such as
a direction key at the end of a
number or complete formula.
The formula or number is
stored in the active cell, and
the cell pointer is moved as
directed.

Example

The simple method of entering a
list of numbers, using a direction
key:

31 (→) 28 (↓) 31 (↓)
30 (↓) 31 (↓)

is a series of Value commands.

Chapter 7

Function Directory

This chapter describes the functions that can be used in Multiplan formulas. The argument to the function, enclosed in parentheses, follows the function name. No space is permitted between the function name and the left parenthesis.

The following abbreviations are used in argument descriptions:

n represents a number. Wherever *n* is shown, only one entry is allowed. When more than one is allowed, *list* is shown.

t represents text.

Important: Text used within functions must be enclosed within quotation marks. For example, "new value."

logical represents a logical value, which must be a reference to a single cell, a for-

mula expressing a relation (=, <, >, <=, >=, <>), or a function that returns a logical value. Otherwise, a #VALUE! error value is returned.

list represents a list of items, separated by commas. An “item” may be either a value that represents itself or a reference to a group of cells that represent the collection of values in those cells. For example, the list

1,Balance

where “Balance” is defined as R1C2:3, and R1C2 contains the value 2 and R1C3 contains the value 3. The list then represents the collection of values 1,2,3. Lists may be up to five items long, but they may represent any number of values through references.

See “Formulas” in the “Elements of Multiplan” section to review the descriptions of numbers, formulas, and text.

ABS(n)

Description

Returns the absolute value of the argument *n*.

Examples

ABS(AVERAGE(R1C1:10) – R1C1)

Tells how far the first item is from the average.

See Also

SIGN for the sign of a number; ABS is equivalent to $n * \text{SIGN}(n)$.

MAX for the maximum of two or more values.

MIN for the minimum of two or more values.

AND(list)

Description

Returns the logical value true if all of the specified argument values are true. Otherwise, returns false.

Requirements

The argument entries must be logical values. If not, the -VALUE! error value is returned.

Example

IF(AND(SUM(Homework) > 82, Final > 50), credit, “not qualified”)

Returns the value of credit if the sum of Homework is greater than 82 and Final is greater than 50; otherwise, “not qualified” is displayed.

See Also

OR and NOT to operate on logical values.

IF to test a logical value.

ATAN(n)

Description

Calculates the Arctangent (inverse Tangent) function of the argument, yielding an angle in radians in the range ($-\pi/2$ to $+\pi/2$).

ATAN can be used to calculate Arcsin and Arccos (see Appendix C, Table 1).

Example

ATAN(degree)

Note: A #NUM! error is returned if your argument exceeds the upper and lower limits. Normalize the argument to correct this.

See Also

TAN for the Tangent function.

AVERAGE(list)

Description

Calculates the average of the specified argument values. Yields the same result as entering the formula:

SUM(list)/COUNT(list).

Examples

AVERAGE(Balance)

AVERAGE(1,5,6.5,5)

See Also

STDEV for the standard deviation of the number values.

SUM for the sum of number values.

COUNT for a count of number values.

COLUMN()

Description

Returns the number of the column in which the formula containing this function appears.

Example

1981 + COLUMN() - 4

Produces the sequence of years 1981, 1982,..., starting in column 4. (Place this formula in column 4, then Copy Right from column 4 as many cells as the number of years you want in the series.)

COS(n)

Description

Calculates the Cosine of the argument, an angle in radians.

Example

COS (degree)

See Also

SIN and TAN for the other trigonometric functions.

COUNT(list)

Description

Returns the count of number values represented by the *list*. Cells are counted only if they contain number values.

Example

COUNT(checks)*0.15 + 1.00

Figures a service charge of one dollar plus 15 cents per check.

See Also

AVERAGE for the average value.

SUM for the sum of the number values.

EXP(n)

Description

Calculates *e* (2.7182818..., the base of the natural logarithm) to the power of the argument. This is the inverse function of LN.

Powers of other bases are calculated using the exponentiation operator (^).

Examples

EXP(1)

EXP(value) - EXP(- value)

See Also

LN for the natural logarithm of a number.

FALSE()

Description

Returns the logical value false.

Example

IF(R1C1,"TRUE",
"NOT TRUE")

Displays "NOT TRUE" if cell R1C1 contains FALSE().

See Also

AND, OR, and NOT to operate on logical values.

IF to test a logical value.

IF(logical, Then value, Else value)

Description

If the *logical* is true, returns the *Then value*. Otherwise, returns the *Else value*. These values may be numeric, text, or logical values.

Example

IF(grade>80,"excellent",grade)

Displays "excellent" if the value of grade is greater than 80, otherwise the actual grade is displayed.

See Also

AND, OR, and NOT to operate on logical values.

ISNA and ISERROR to check for error values.

INDEX(area,subscripts)

Description

Returns the value of a cell selected by *subscripts* from the rectangular *area*.

One or two subscripts may be given. With one subscript, the area must be part of one row or one column. Subscript value 1 selects the first cell in the row or column, value 2 the second cell, and so on.

If two subscripts (separated by commas) are given, the area may be rectangular. The subscripts select the row and column in the area, starting at 1 in each case.

If any index exceeds the limits of the area, the #N/A (not available) error value is returned.

Examples

If TABLE is the rectangular area:

15	20	35
50	75	10

then:

INDEX(TABLE,1,1)

returns "15"

INDEX(TABLE,2,3)

returns "10"

If the area Score is a table giving adjusted composite scores for raw scores on two components in a test, then:

INDEX

(Score,Raw1 C,Raw2 C)

will give the appropriate composite score, based on the two raw scores.

INT(*n*)

Description

Returns the largest integer less than or equal to *n*.

Examples

INT(6) is 6

INT(8.9) is 8

INT(-123.999) is -124

See Also

ROUND to round a number to a certain decimal place.

ISERROR(*value*)

Description

Returns the logical value true if the argument is any of the error values (#N/A, #VALUE!, #REF!, #DIV/0!, #NUM!, #NAME?, #NULL!). Otherwise, returns false.

Example

IF(ISERROR(ratio),"check your numbers","")

Displays "check your numbers" if ratio contains any erroneous formula or value, or is not defined.

See Also

IF to test a logical value.

ISNA(*value*)

Description

Returns the logical value true if the argument is #N/A (not available). Otherwise, returns false.

Example

IF(ISNA(balance),"0",balance)

Displays balance if available, or the number 0 if no balance has been entered.

See Also

NA to produce #N/A value.

IF to test a logical value.

ISERROR to test for all error values.

LN(*n*)

Description

Calculates the natural logarithm of the argument.

Requirements

n must be positive. A #NUM! error value is returned if *n* is less than or equal to zero.

Example

LN(value)/LN(2)

See Also

ABS to ensure that the argument is positive.

EXP for the inverse of LN.

LOG10 for logarithms to the base 10.

LOG10(*n*)

Description

Calculates the base 10 logarithm of the argument.

Requirements

n must be positive. A #NUM! error value is returned if *n* is negative.

Example

LOG10(value)

See Also

ABS to ensure that the argument is positive.

LN for logarithms to the base *e*, and other bases.

LOOKUP(*n,table*)

Description

Searches for *n* in the first row or column of *table*. Returns the contents of a cell from the last row or column of *table*. *Table* is a group of cells on the worksheet.

The dimensions of *table* determine the direction of the search.

If *table* is square, or higher than it is wide, Multiplan searches in the first column of *table* until it finds the cell that has the largest value that is less than or equal to *n*. The value in the last cell in that row of *table* is returned as the result of the function. If the values in all cells in the first column are less than *n*, the last row

of *table* is used. If the values in all cells in the first column are greater than *n*, a #N/A value is returned.

If *table* is wider than it is high (has more columns than it has rows), then Multiplan searches for *n* in the first row of *table*. The value in the last cell in that column of *table* is returned as the result of the function. If the values in all cells in the first row are less than *n*, the last column of *table* is used. If the values in all cells in the first row are greater than *n*, a #N/A value is returned.

Requirements

Table should be a cell reference to a rectangular area in the active worksheet. The result returned may be either a number value, a text value, or a logical value.

LOOKUP expects that you entered the values in the first row or column in ascending order. If values are not in ascending order, LOOKUP may return either the #VALUE! or #N/A error value.

Example

Assume that column 1 (C1) lists base salaries, column 2 (C2) lists minimum tax, and column 3 (C3) lists marginal tax rates as percents:

C1	C2	C3
0	0	0
2300	0	.14
3400	154	.16
4400	314	.18
6500	692	.19
8500	1072	.21
...

Also assume that a name 'Salary' has been defined and that it contains a value *n*.

The tax on a salary in one of the brackets in *table* can be expressed as:

```
LOOKUP(Salary,C1:C2)+
(Salary-LOOKUP(Salary,C1))
*LOOKUP(Salary,C1:C3)
```

Notice that in the first lookup, we find the tax on the "base" amount (using C1 to find a value in C2). In the second lookup, we find the actual base amount (using C1 to find a value in itself; in fact, Table can be one column wide or one row high). And in the third lookup, we find the marginal tax rate for the amount of the salary that exceeds the base amount (using C1 to find a value in C3).

MAX(list)

Description
Returns the largest number value from List. Returns zero if *list* represents no number values.

Example
MAX(scores)

Displays the largest number in the area defined as "scores."

See Also
MIN for the minimum of two or more values.

MIN(list)

Description
Returns the smallest number value from *list*.

Example
MIN(scores)

Displays the smallest number in the area defined as "scores."

See Also
MAX for the maximum of two or more values.

MOD(dividend,divisor)

Description
Returns the remainder of *dividend* divided by *divisor*. The result has the same sign as *divisor*.

Requirements
Both parts of the argument must be an *n* value. If *divisor* is zero, a #DIV/0! error value is returned.

Example
MOD(3,2) = 1
MOD(-3,2) = 1
MOD(-3,-2) = -1
MOD(3,-2) = -1

In general:
MOD(x,y)=x-INT(x/y)*y

NA()

Description
Returns the #N/A (not available) special value. This value may be used to mark data points that are yet to be defined.

Example
By assigning NA() to the interest rate, all values on the worksheet that depend on the interest rate will change to #N/A.

NOT(logical)

Description
Returns the opposite of the logical value argument (false if the argument is true; true if the argument is false).

Example
NOT(TRUE()) is equivalent to FALSE().

See Also
AND and OR to operate on logical values.
IF to test a logical value.

NPV(rate,list)

Description
Net Present Value (NPV) calculates the amount of money required now to produce a specified cash flow in the future, given some interest rate.

The formula used is:

$$\sum_{i=1}^n \frac{\text{list}_i}{(1 + \text{rate})^i}$$

Requirements

Rate is an interest rate, expressed as a decimal fraction (0.11 is a rate of 11%). It must be an *n* value.

The first value represented by *list* is income required at the end of the first period, the second the income required at the end of the next period, and so on.

Example

You are given the opportunity to lease a parking lot for five years for an \$80,000 one time payment. The lot currently generates \$15,000 net operating income annually. Based on research and profit studies you have done, you expect the income to increase 30% annually.

Place \$15,000 in cell R1C1. Place =RC[-1]*1.3 in cell R1C2, and copy it right to the next three cells. Name the area Flow. Now, you can figure the net present value of the cash flow.

If your opportunity rate is 15%, then NPV(.15,Flow) gives you the present value of \$84,598.24. Since this is greater than the cost of the lease, you conclude that it is a worthwhile investment.

OR(list)

Description

Returns the logical value, true, if any value in *list* is true. Otherwise, returns false.

Requirements

The argument entries must be logical values. If not, the #VALUE! error value is returned.

Example

IF(OR(grade>80,final>=150), "good work", "")

Returns "good" "work" if grade is greater than 80, or if final is greater than or equal to 150, otherwise an empty cell is returned.

See Also

AND and NOT to operate on logical values.

IF to test a logical value.

PI()

Description

Returns the value 3.1415926535898, an approximation of the mathematical constant π .

Example

SIN(PI()/4)

ROUND(n,digits)

Description

Returns a value, rounded to the number of decimal places specified by *digits*.

Digits specifies the rounding as follows:

If *digits* is greater than zero, then the result will be rounded to that many decimal places. For example, ROUND(3.1416,3) produces 3.142.

If *digits* is zero, the result is rounded to an integer.

If *digits* is negative, rounding is carried into the integer. For example, ROUND(21, -1) produces 20 while ROUND(991, -2) produces 1000.

Requirements

Digits must be an *n* value.

Example

Balance + ROUND(Balance*Interest/12,2)

See Also

INT to return the integer part of a number.

ROW()

Description

Returns the number of the row in which the formula containing this function appears.

Example

Copying the expression ROW()*10 throughout the first column creates the sequence of numbers:

10

20

30

...

See Also

COLUMN for the current column number.

SIGN(n)

Description

Returns a number representing the algebraic sign of the argument.

If the sign of the argument is positive, the function returns 1.

If the argument value is zero, the function returns 0.

If the sign of the argument is negative, the function returns -1.

Example

SIGN(-10) returns -1
SIGN(0) returns 0
SIGN(3) returns 1
SIGN(I)*I returns the absolute value of I

See Also

ABS to return the absolute value of a number.

SIN(n)

Description

Calculates the sine of the argument, an angle in radians.

Example

SIN(degree)

See Also

COS and TAN for the other trigonometric functions.

SQRT(n)

Description

Returns the square root of the argument.

Requirements

N must be positive. If *n* is negative, a #NUM! error value is returned.

Example

SQRT(x*x + y*y)

STDEV(list)

Description

Calculates the sample standard deviation of the number values represented by *list* according to the formula:

$$S = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n - 1}}$$

Example

STDEV(grades)

See Also

AVERAGE for the average value.

SUM(list)

Description

Returns sum of number values represented by *list*.

Example

(1 + rate)*SUM(deposits__Jan)

See Also

MAX for the maximum of two or more values.

MIN for the minimum of two or more values.

AVERAGE for the average value.

COUNT for the count of the number values.

TAN(*n*)

Description

Calculates the tangent of the argument, an angle in radians.

Example

TAN(degrees)

See Also

COS and SIN for the other trigonometric functions.

ATAN for the inverse tangent function.

TRUE()

Description

Returns the logical value true.

Example

IF(R1C1,"YES","NO") returns YES if R1C1 contains TRUE(), and NO if R1C1 contains FALSE().

See Also

AND, OR, and NOT to operate on logical values.

IF to test a logical value.

Appendices

A. Message Directory

B. Helpful Hints

C. Glossary

D. Notes for the VisiCalc™ User

E. The SYLK File Format

Appendix A / Message Directory

The following directory lists in alphabetical order all the possible messages that Multiplan may display, along with descriptions.

Bad file format. An attempt was made to load a file that was not a Multiplan worksheet. Check the directory for the correct name and try again.

Bad file name. The name you entered does not meet either Model 100 or Multiplan's specifications.

n bytes free. Displays when you exit the Option command. Useful for keeping track of worksheet size.

Cannot write file. Indicates a printer problem. Press **(BREAK)** (**(SHIFT) (PAUSE)**) to regain control of Multiplan. Check the printer for proper connections, power and ribbon.

n cells to recalculate. Appears when a new value is entered into the worksheet that causes Multiplan to recalculate values on the worksheet. It is also displayed if you press the **RECALC** key (**(F1)**) after entering a new value while Multiplan was not in automatic recalculation mode. This message appears only if there are a lot of cells to be recalculated.

Circular references unresolved. Cells refer to each other in a chain so that the last refers back to the first. (The simplest case is a cell containing a reference to itself (RC) but the chain may be many steps long.) Multiplan has calculated all the cells of the chain once and found itself starting over. It stops calculating, leaving the cells in the circular chain in an undefined state.

Use the same methods described in "Formulas" in the "Elements of Multiplan" section of this manual for finding the source of error values.

Directory full. There is no more room in the Model 100 directory. Quit Multiplan and save some files to either cassette or diskette, then delete them from the directory. Restart Multiplan.

File already exists. The filename you specified already exists in the Model 100's directory. This occurs when saving SYLK mode files only. Try again with a different filename.

File not found. The filename you specified does not exist. This error occurs when loading Normal mode or SYLK mode files.

File already open. Internal error. Call Radio Shack Service Center.

File format error: line.

Attempt to load a non-SYLK file as a SYLK file.

Function call error. Internal error. Call Radio Shack Service Center.

Illegal formula. Multiplan displays this message when a formula is entered that contains an error. See the rules in "Formulas" in the "Elements of Multiplan" section of this manual. The highlighted area begins at the point an error was noted.

Check all punctuation, especially parentheses, quotes, and brackets. Check the spelling of function names. Check for a mismatch of data types, as in concatenating text to a number.

Illegal parameter. One field of the command last entered had a numeric response that was illegal. For instance, if the "# cells" field of Copy Down was given the response 299, this message would appear when **(ENTER)** was pressed. There are only 99 rows, so 299 copies could never be made.

Out of memory. Multiplan has run out of storage space (worksheet is too big).

Save the sheet at once to either cassette or diskette. Then consider ways to simplify it. Blank cells take little space, so blank any unwanted cells. See Appendix A, "Helpful Hints" for suggestions on how to make your worksheet smaller.

Name too long. Names may not exceed 31 characters. The name you have entered exceeds this.

Printer error. The printer is not responding to a Multiplan request. Press **(BREAK)** (**(SHIFT) (PAUSE)**) to regain control of Multiplan. Check to see if the printer is connected properly and ready to print.

Prompt too long. The value entered in the current field is too long. Shorten the value.

Reading line n. Displayed when a symbolic file is read.

Unidentified system error or break. Displayed when the **(BREAK)** key is pressed during an operation. Can also indicate printer or computer problems.

Appendix B / Helpful Hints

This appendix offers hints for saving space in memory and on your cassettes/diskettes, for saving time during your Multiplan sessions, and for making Multiplan easier to use.

1. Keep the worksheet compact. Keep the amount of blank space within the worksheet to a minimum. Also, avoid extending the worksheet size unnecessarily.

Placing any number outside the general work area, even formatting a cell unintentionally, can use more memory and cassette/diskette storage than necessary.

2. Place common subexpressions in an intermediate cell, then refer to that cell when the subexpression is needed in a formula in another cell. This saves retyping and recomputing the same information. For example, if SUM(Sales) appears in several formulas:

```
MIN(1000,SUM(Sales))
SUM(Sales)*commission ÷
AVERAGE(Sales)
    (this example has it hidden)
```

it is more efficient to compute SUM(Sales) once in a cell, then refer to that cell from the formulas. Having the intermediate result visible also helps with tracing problems in the setup of the formulas.

3. Define names for the common areas on your worksheet. By defining names, you speed up references to a group of cells. For example, it is much easier and faster to type "Sales" than R2C3:15, or "Hotspots" than R3C4,R5C6,R5C8. Use the REFERENCE key (**Ⓔ**) to enter names directly from the name table.

4. Use the Copy commands for filling in cells with identical values, especially formulas, but also numbers and text. Copying is simpler, less error prone, and more space efficient than manually entering repeated values into cells individually.

5. To copy quickly the format of a group of cells into another part of the worksheet, first copy the group of cells as they are. Then, blank the cells in the new area.

6. Use primitive forms of references wherever possible. For example, it is more efficient to use R2C2 than R2 C2; or R1:2C1 than R1C1:R2C1.

7. Turn off automatic recalculation, and use the RECALC key (**Ⓘ**). This way you can enter new values and edit current values without waiting for each recalculation. Recalculation also occurs when you change text.

8. Format entire rows or columns at one time. Formatting entire rows or columns does not extend your worksheet.

9. Avoid functions or operations over unnecessarily large ranges. For example, instead of SUM(R2), specify only the range of columns that contain values, for instance SUM(R2C1:5). Or, try to restructure the function or operation so that large ranges are not necessary.

10. Avoid extensive use of forward references because they are slower to recalculate. For example, a reference to cell R10C10 from cell R5C5 is slower than a reference to R5C5 from R10C10.

11. Use the HOME, and END keys to scroll rapidly across and down the worksheet.

12. Perform similar operations together. Try to define all names at once. Copy all cells at once. Many Multiplan commands offer you proposed responses. By performing similar operations together, you can make maximum use of the proposed responses, which saves considerable time.

13. Position the cell pointer before selecting a command. This also makes it easier to use proposed responses.

Appendix C / Glossary

Absolute reference. A reference to a cell that uses specific row and column numbers; for instance, R17C12. Opposed to relative reference, as R[+1]C[-2].

Action keys. Keys that cause Multiplan to carry out an action at once. The action keys include the **BREAK** key, and **ENTER** key. See also Direction keys, Edit keys.

Active. Something in use right now and immediately accessible, such as the active cell, or active field of a command.

Active cell. The cell indicated by the cell pointer. The contents of the active cell can be seen with the Options command and may be edited with the Edit command.

Alignment. The rule for the horizontal positioning of the display of a cell's value. Values may be left justified or right justified or centered.

BREAK key. Action key that causes Multiplan to abandon the current command and return to command choice.

Cell. One position on the worksheet, a place where data or a formula may be stored. A cell has a location and may be referred to by one or more names. The contents of a cell determine its value; the cell's format determines how its value is displayed.

Cell pointer. A highlighted pointer that selects one cell from all the cells in the worksheet. That cell becomes the active cell. The cell pointer is moved from cell to cell with the direction keys, or directly with the Goto command.

Character. A symbol that can be displayed on the screen; includes letters, digits, punctuation, and special characters like \$, +, and %.

Column. A vertical line of cells down the worksheet. There are 63 columns, designated by the numbers 1 through 63.

Command. An instruction to Multiplan to do something. A command may have one or more fields in which to specify how the command should be carried out.

Command line. The screen line at the bottom of the worksheet area. It is only displayed when the **[LABEL]** key is pressed. Press the **[LABEL]** key again to turn the command line display off.

Contents (of a cell). That which has been put into a cell. If nothing has been put in, the cell is empty and its contents are blank. Otherwise the cell contains either data (text or a number) or a formula. If a cell contains a formula, the cell's value, which is the result of the formula, is usually displayed.

Cursor. The highlighted part of a command on the command line, which may be as small as one character or as large as an entire field. The edit cursor is moved with edit keys. It shows where alterations can be made to the command.

Direction keys. Keys that move the cell pointer. The **[←]**, **[→]**, **[↑]**, **[↓]** keys move the pointer one cell at a time. The HOME key moves it to the cell in the upper left corner of the active window.

Edit. Altering a response in a field of a command. The edit keys are used to move the edit cursor over the response, and the character keys are used to replace or insert characters.

Edit keys. Keys that move the edit cursor within the command line. Includes, for example, **[↑]** and **[↓]** keys.

Field. A portion of a command in which you type a response to instruct Multiplan in some detail of the command's work. When Multiplan first shows a field, it fills it with a proposed response; you can replace or edit that response if it is not what you want.

File. A named unit of data stored in RAM, or on cassette or diskette. When a worksheet is saved it is written into a file. Not all files are saved worksheets, but those that are can be loaded or linked to other worksheets.

Filename. The name used to refer to a worksheet when it is saved or loaded.

Format. How a cell's value is displayed. The format controls numeric punctuation and the alignment of the displayed value. A format can be specified for a cell or cells with the Format Cells command; cells without a specific format are displayed according to the default setting which is right justified and general format.

Formula. A recipe for how a value is to be calculated. Whenever the contents of a cell are changed, Multiplan recalculates all the formulas on the worksheet (unless automatic recalculation is turned off).

Function. A built-in mathematical or statistical operation that Multiplan can perform on one or more values; e.g., SUM or AVERAGE.

Group of cells. A collection of one or more cells on the worksheet that may be named; e.g., Sales.

Highlight. An area on the display that appears emphasized. Highlights are used to indicate the edit cursor, active cell, active window number, and current menu item.

Load. To make a saved sheet active again. The sheet to be loaded must have been saved. The Transfer Load command is used to copy the saved sheet from its file to working storage, where it becomes the active sheet.

Menu. A list of alternatives. A choice from a menu is selected by pressing the appropriate function key.

Message. A notice posted by Multiplan on the message line to explain a problem or suggest what kind of input the system is waiting for.

Message line. The top line on the display.

Name (of a cell or group of cells). A tag associated with a group of cells by the Name command. The name can be used to refer to the cell or cells in formulas.

Proposed response. Response supplied by Multiplan. It is usually based on the most recent responses by the user or on the current status of Multiplan.

Range. The smallest rectangle of cells containing two references. A range is designated by the colon (:). The range R3:R8 defines the rectangular area containing all of rows 3 through 8, namely rows 3, 4, 5, 6, 7, and 8. *See also* Reference.


Reference. The designation of a cell or an area of cells. The simplest reference is to a single cell: R9C2. A reference may be relative to the cell containing the reference, as in R[-1]C. A reference may be to a single cell, as the prior two, or to an area of cells: R6 refers to all of row 6. A reference may be composed of intersections of references, ranges of references, or unions of references. A reference may be a name defined to refer to one or more cells. *See also* Range and Name.

Relative reference. A reference to a cell relative to the cell containing the reference, as R[-1]C meaning "the row above, in this column." Opposed to absolute reference, in which the actual column and row numbers are stated.

Response. What the user types in a field of command. May be a row or column number, a count, a name, or the contents to be put in a cell. When Multiplan displays a command on the command line, it usually supplies a proposed response in every field of the command; the user may replace the proposed response, edit it, or leave it as proposed.

Row. A horizontal line of cells across the worksheet. There are 99 possible rows, designated by the numbers 1 through 99.

Save. The operation of making a permanent copy of the active worksheet in a cassette or disk file.

Scroll. To move across the worksheet one row or column at a time. Scrolling is done with the direction keys. For example, if the  key is pressed until the cell pointer reaches the right edge of the screen, and then pressed again, Multiplan scrolls the worksheet display one column to the left.

Text. String of characters that may be used for titles in the worksheet.

Value. The information content of a cell: its numeric value if it contains a number; its text if it contains text; or, if it contains a formula, the result of calculating that formula.

Worksheet. A grid of cells displayed by Multiplan to store formulas and values.



Appendix D / Notes for the VisiCalc™ User

If you have used VisiCalc previously, you are probably curious about how that product differs from Multiplan. This appendix compares the operations and features of the two. Described first are the operations the two programs have in common, roughly in the order they are presented on the VisiCalc reference card. The features unique to Multiplan are described second.

Moving the Cell Pointer

The four direction keys move the cell pointer around the active window. The HOME key sends the cell pointer to the upper left corner of the worksheet. The END key sends the cell pointer to the lower right corner of the data area. You may also move the cell pointer to a specific cell with the Goto command, which lets you move to a particular row and column or to a particular cell by name (see "Names" below).

Correcting Errors, Canceling Commands

In Multiplan, the  key cancels any command you have begun. The  key erases the last character typed. There are several other editing keys used to correct typing errors (see Chapter 8).

Entering Titles and Text

In Multiplan, a cell may contain a title or simple text made of characters documenting a row or column on the worksheet. To enter text, type the title and press **ENTER** or any direction key.

Entering Numbers

A cell may contain a number. To enter one, just start typing it. Put the finished number in the active cell by pressing **ENTER** or any direction key. Numbers may be in decimal form or in scientific notation.

Entering Formulas

A formula is composed of text, numbers, cell references, operators (+ — * /), and function names (SUM, MIN, etc.). Unlike VisiCalc, but like most programming languages, Multiplan evaluates formulas according to the precedence of operators: exponentiation (^) first, then multiplication (*) and division (/), then addition (+) and subtraction (—), and finally text concatenation (&). You may use parentheses to change the order of calculation.

Values can be compared using the operators less than (<), greater than (>), less than or equal (<=), greater than or equal (>=), equal (=), and not equal (<>).

The % (percent) operator is unique to Multiplan.

To enter a formula, first type =, then the formula. Within a formula, you may enter a reference to another cell by pointing to that cell with the direction keys. All the editing keys are available to you while entering a formula.

References

Note that Rows and Columns are both numbered, the Row indication given first. Thus, the VisiCalc reference B3 can be written in Multiplan as R3C2.

In a formula, you may refer to the value of a cell or a group of cells in any of several ways. You may give an absolute reference to a row and column (R3C5) or to a range along a row or column (R3:6C9, R5, C1:8). You may give a reference relative to the cell holding the formula (R[-1] C for "this column, one row up"). Most important, you can give a name to any cell or group of cells. For instance, the name Sales might refer to R9C2:9 (row 9, columns 2 through 9). The formula SUM(Sales) produces the sum of all numbers in those cells.

References of any of those three kinds may be combined by intersection or union to make other references (see "Elements of Multiplan" for details and examples).

Multiplan Names

In Multiplan, the Name command allows you to define a name as a reference to a single cell, or to a group of cells. Once you've done so, you may use that name as an argument of a function or, in many cases, as a response in a command. A name must start with a letter, and it may contain letters, numbers, periods (.), and underline (—) characters, up to 31 characters maximum.

This naming ability can make a big difference in the clarity of your sheets. Consider this formula (as VisiCalc presents it):

B1 * B2 * (1-B3)

Notice the improvement if you write it using names:

Quantity * Price * (1 — Discount)

The Name command also allows you to review your name definitions using the direction keys.

Functions

Multiplan supports all of the functions familiar to you from VisiCalc, and others unique to Multiplan. Table 1 compares the Multiplan functions with their VisiCalc counterparts. See the "Function Directory" section for details on each Multiplan function. Note that Multiplan function names do not begin with "@".

Multiplan also provides several unique functions. See Table 2.

Commands

Multiplan commands are chosen from the menu by highlighting a command word or by typing the first letter of a menu item. Table 3 shows the Multiplan commands and their VisiCalc counterparts (for complete details on the Multiplan commands see the "Commands Directory" section). Remember as you scan Table 3 that you type only the capitalized letters when choosing a Multiplan command.

If a command has more than one argument "field," they are separated by **TAB** instead of **ENTER**, as in VisiCalc. In Multiplan, **ENTER** executes the command.

It is worth noting that the Multiplan Insert command can operate on more than one row or column at a time. You can Insert several blank rows. Multiplan adjusts all references (absolute or relative) and name definitions to account for the changes.

The Multiplan Format command can set the format of one cell or of a group of cells.

Multiplan automatically recalculates cells until all have reached the correct values (or until Multiplan finds an endless chain of references) so the

VisiCalc “/GO” (order of calculation) command is not needed. You do not have to be concerned with the order of calculation in Multiplan, or worry about forward references.

Printing

Multiplan has a full set of printing operations, invoked by the Print command. You may print all or any rectangular area of the worksheet; an area can be specified by name or specific references.

Copying Cells

Multiplan's Copy command performs the operations that, in VisiCalc, are done with “/R”. Copy Down and Copy Right provide especially easy ways to duplicate one cell down a column or across a row. The general Copy From operation will duplicate a single cell into an area of any shape, or duplicate an area of any shape in another area of the same shape. Multiplan does not ask whether references should be adjusted; if you build your formulas with relative references and names, they will be position-independent.

Worksheet Transfers

The Transfer command handles operations on the whole worksheet.

The DIF™ format is not directly supported by Multiplan. However, DIF™ files can be readily converted into the Multiplan SYLK format described in Appendix E.

Table 1

Multiplan Functions and Their VisiCalc™ Counterparts

<u>Multiplan</u>	<u>VisiCalc</u>
ABS(N)	@ABS(N)
use PI()/2-ATAN(N/SQRT(1-N*N))	@ACOS(N)
AND(list)	@AND(list)
use ATAN(N/SQRT(1-N*N))	@ASIN(N)
ATAN(N)	@ATAN(N)
AVERAGE(list)	@AVERAGE(list)
INDEX(area,subscripts)	@CHOOSE
COS(N)	@COS(N)
COUNT(list)	@COUNT(list)
use undefined name	@ERROR
EXP(N)	@EXP(N)
FALSE()	@FALSE
IF(l,v1,v2)	@IF(l,v1,v2)
INT(N)	@INT(N)
ISERROR(N)	@ISERROR(N)
ISNA(N)	@ISNA(N)
LN(N)	@LN(N)
LOG10(N)	@LOG10(N)
LOOKUP(N, area)	@LOOKUP(N,range)
MAX(list)	@MAX(list)
MIN(list)	@MIN(list)
NA()	@NA
NOT(l)	@NOT(l)
NPV(dr, list)	@NPV(dr,range)
OR(list)	@OR(list)
PI()	@PI
SIN(N)	@SIN(N)
SQRT(N)	@SQRT(N)
SUM(list)	@SUM(list)
TAN(N)	@TAN(N)
TRUE()	@TRUE

Table 2
Functions Unique to Multiplan

<i>Function</i>	<i>Description</i>
COLUMN()	Current column number
MOD(<i>n1</i> , <i>n2</i>)	Remainder of <i>n1</i> / <i>n2</i>
ROUND(<i>n</i> , <i>d</i>)	Value of <i>n</i> rounded to <i>d</i> decimal places
ROW()	Current row number
SIGN(<i>n</i>)	-1, 0, or +1 depending on <i>n</i>
STDEV(<i>list</i>)	Standard deviation

Table 3
Multiplan Commands and Their VisiCalc™ Counterparts

<i>Multiplan</i>	<i>VisiCalc</i>
Blank	/B
Transfer Clear	/C
Edit	/E
Format Cells	/F
Format Width	/GC
Insert Columns, Insert Rows	/I
Print	/P
Copy	/R
Transfer Load	/SL
Quit	/SQ
Transfer Save	/SS
Option	/V
Goto Row-Col	>
RECALC key	!
use references	#

Appendix E / **The SYLK (Symbolic Link)** **File Format**

The purpose of the SYLK (SYmbolic LiNK) format is to exchange information between Multi-Tools and application programs. The format is designed with extensibility, ease of generation, ease of parsing, and storage efficiency in mind. The worksheet can be completely represented by SYLK files. This means that a program can generate a Multiplan worksheet, such as a program to build a cash-flow forecasting worksheet from a general ledger chart of accounts. It is useful to subdivide the definition of SYLK into the following "layers":

1. SYLK record and field formats: this layer provides for the identification of the files, a degree of data compression, and an easy way for a program to separate information that is important for its purpose from information that the program is not interested in handling.
2. The "C" or cell or data point record. This is probably the record type of the most universal interest.

3. Other Multiplan-specific records and fields. This collection of formats affords complete control or complete overview for a communicating program of the state of a Multiplan session, including the worksheet, windows, options, etc.

The first layer is defined as follows. The contents of a SYLK file—encoded in ASCII—are divided into records by either CR or LF characters. Empty records are ignored. Nonempty records are further subdivided into an RTD (record-type descriptor) optionally followed by a list of fields. Each field in the list is preceded by an FTD (field-type descriptor). The contents of the fields is determined by the RTD and the FTD, as described below:

RTDs consist of up to two letters. They determine the meaning of the record according to the standards described below.

FTDs consist of a semicolon and a single letter that determines the meaning of the field. The meanings of FTD's ;U, ;V, ;W, ;X, ;Y, and ;Z will be the same for all records. The meanings of other FTD's will depend on the record type.

The field contents can be arbitrary except for the following: CRs or LF's may not be included, and semicolons must be doubled.

A degree of data compression is achieved by the following rule: for certain fields, the last field value will be automatically substituted if the field contents are empty. Such fields are said to be differentially encoded and will be marked by (diff) in their description.

The FTDs ;X and ;Y determine x and y coordinates in a worksheet or other two-dimensional space containing data points. Coordinates of the first cell are 1,1. ;X and ;Y are differentially encoded, and they may be altogether omitted from records if the last defined value is to be used.

In general, programs that process SYLK files cannot be expected to handle all RTD's, all FTD's, or even the full range of field contents for two reasons. First, their interest may be limited to some aspect of the available data. Second, SYLK may very well be expanded after the release of the program in question. This means that programs must be prepared to ignore records and fields that they do not understand. Data with coordinates that lie outside of the space that the program can process should be also ignored.

Note: Your Model 100 Multiplan program does ignore certain RTDs, FTDs, and fields that other Multiplan programs use.

The following data records and fields are currently defined:

Record type: C

These records describe a data point that exists in a two-dimensional space with coordinates ;X and ;Y. The Multiplan concept of cell is one example of a data point. Besides its coordinates, data points may also possess a number or text value, an expression, a protection state (locked or unlocked), and several Multiplan-specific properties. Formatting properties for data points may be specified in a separate record type (F, see below).

Fields are:

;X, ;Y
(diff) cell coordinates.

;K
Value of the data point. Numerical values are given in decimal or exponential form (see Multiplan "Gen" format code). Text values are enclosed in double quotes. The logical values TRUE and FALSE are given this way. Error values are preceded by - and appear as in Multiplan.

;E
An expression that computes the value of the data point. The field contents appear exactly as a Multiplan formula.

;R, ;C
(diff) Used by ;S

;S
Expression for the data point is given at another coordinate. X is given by ;C (column), y is given by ;R (row). The field contents are decimal coordinates. Note that ;E must not appear together with ;S. Moreover, the data point at (;R, ;C) must be marked with either ;D or ;G. In the latter case, the value of the data point is taken to be the (constant) expression.

;D
;E Expression is shared by some other data point.

;G
;K Value is shared by some other data point. ;E Must not appear.

Record type: B

Defines the bounds of the two-dimensional space of data points. This record should appear at the beginning of a SYLK file.

Record type: E

Defines the end of the SYLK file.

Record type: F

Describes the Multiplan formatting properties of individual cells or of the whole worksheet. (See also the descriptions of the Format group of commands in Chapter 12.)

Fields are:

;X, ;Y
(diff) Cell coordinates.

;Fc1nc2
(diff) Cell formatting properties are defined by the contents where c1 is a one-character formatting code (F, G, \$), n is the "# of digits" argument, and c2 is a one-character alignment code (C, L, or R).

;R, ;C;F
Properties are to be applied to a whole row or whole column of the Multiplan worksheet. Contents are decimal row or column numbers, respectively.

;K, ;E
Appear if the the commas and formulas Format Options are set, respectively.

;Wn1 n2 n3
Defines the width of all columns in the worksheet where n1 is the first column (x), n2 is the last column of the worksheet, and n3 is the width of the columns expressed as number of characters (cf. Format Width command).

Record type: ID

The first record in the SYLK file must be an ID record. This convention helps with the identification of the file as a SYLK file.

Field is:

;Pname

The name of the program that produced the file (for example, MP).

Record type: NN

This record defines a Multiplan name as a union of rectangular areas expressed with absolute references (see also the Name command, Chapter 9).

Fields are:

;Nname

The name to be defined.

;Ee

Expression describing the area.

Its general form is:

Rn11:n12Cn13:n14,Rn21:
n22Cn23:n24,...

Ranges over single values may be written without the ":" operator. Ranges R1:99 or C1:63 (but not both) may be omitted.

Order of records

There are only a few restrictions on the order of records in SYLK files.

1. ID must be the first record.
2. B should be used (although not required) for Multiplan input.
3. For Multiplan C records: ;D or ;G must appear before another C record that refers to it (with ;S, ;R, ;C).
4. Name definition should precede name use for efficiency, although this is not required.
5. NU records must precede NE records.
6. E must be the last record.

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